METAL INDUSTRY

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Electroplaters' Convention in Cleveland

Twenty-fourth Annual Convention will be Held June 1-4 at the Carter Hotel. Strong Program; Large Exhibition of Equipment, Supplies and Finishes; Plant Visits and Entertainment.

By F. J. HUNTLEY
Detroit, Mich.

NO better place can be found anywhere in the United States than Cleveland for the Annual Convention of the American Electro-Platers' Society which opens on the first day of June and continues until the 4th, with headquarters at the Carter Hotel.

With half of the population of the United States and Canada living within an overnight's ride, maximum attendance is a regular report at Cleveland conventions. Every means of transportation—air, water, motor and rail—is available to bring a vistor to this lovely city.

During the lake navigation season it is particularly pleasant to make the trip by steamer. All water routes are synchronized with railroad schedules to and from all important centers so that one's journey always requires the minimum of time and effort.

Transportation Arrangements

A concession of one and one-third fare on the Receipt Certificate Plan will apply for all attending the Convention. Tickets will be on sale at the regular adult one-way rate May 29th through June 3rd, inclusive. Be sure to ask for a Certificate Plan Certificate when purchasing the going ticket. Do not ask merely for a receipt.

Present yourself at your ticket office at least thirty minutes before train time when beginning your journey.

Certificates are not kept at all stations. It is suggested that you inquire at your home station and discover if the agent can issue a through ticket and certificates to Cleveland. If not, he will inform you as to the nearest station at which they can be obtained.

Immediately upon your arrival at Cleveland, present the certificate to our Wm. E. O'Berg, who has been authorized by the railroads to endorse all certificates.

The certificates will be returned to you, after the Special Railroad Agent has validated same, as the reduced fare for the return trip will not apply unless properly endorsed.

Validation will continue during the days of the Convention so it will not be necessary to wait until the last day before your Certificate is ready.

Return tickets, however, must be purchased before June 7th, but will be good for a return passage at any time within thirty days of date of sale of going fare.

As in the past, the granting of this concession is contingent upon the presentation of 100 or more certificates.

It is reported that the red tape to be unravelled before the ICC tariff reduction is effective will delay

the application of the new rates to Cleveland. It has been pointed out this rate is only applicable to coach fares, and that the average cost of mileage under the certificate plan will closely approximate this rate with the added advantage of first class passage particularly in night travel. **A Leaflet on transportation will be found in the program.**

Hotel Accommodations

Cleveland's hotel accommodations for its many convention visitors are splendid. Six hotels alone have 4,500 rooms—each with private bath. Designed for conventions, modern and well equipped, these hotels assist materially in making the convention in Cleveland successful. Always there are ample assembly, banquet and conference rooms available for any occasion.

Carter Hotel, Cleveland, Ohio

Hotel Rates

	No. of	ROOM—ONE PERSON		ROOM—TWO PERSONS With Bath		
	Rooms	With Bath	Without Bath	Double Bed	Twin Beds	Without Bath
ALLERTON Chester Ave. and E. 13th St.	550	$2.00 to 3.50	$1.50 to 2.00	$4.00	$4.50	$2.50 to 3.00
AUDITORIUM St. Clair Ave. and E. 6th St.	300	2.00 to 3.00	.....	3.50 to 4.50	5.00 to 6.00	.....
CARNEGIE 6803 Carnegie Ave.	60	2.00 to 2.50	1.50	3.00 to 3.50	4.00	2.00 to 2.50
CARTER Prospect Ave. and E. 9th St.	600	2.50 to 5.00	.....	4.00	5.00 to 8.00	.....
CLEVELAND Public Square	1000	2.50 to 6.00	.....	4.00 to 6.50	5.00 to 10.00	.....
COLONIAL 523 Prospect Ave.	200	2.00 to 4.00	1.50 to 2.00	3.00 to 6.00	3.50 to 6.00	2.50 to 3.50
FERN HALL 3250 Euclid Ave.	120	1.50 to 2.50	.....	2.00 to 3.00	3.00 to 4.00	.....
GARFIELD 3848 Prospect Ave.	100	1.50 to 2.50	1.00 to 1.25	3.00 to 4.00	4.50	2.00 to 2.50
GILLSY 1811 E. 9th St.	300	1.50 to 2.50	1.25 to 1.50	2.25 to 3.50	3.50 to 4.00	2.00 to 3.00
HOLLENDEN Superior Ave. and E. 6th St.	1000	2.50 to 5.00	.....	4.00 to 6.00	5.00 to 12.00	.....
MECCA 1862 E. 9th St.	120	1.50 to 2.00	.....	2.50 to 3.00	.....	.....
NEW AMSTERDAM Euclid Ave. and E. 22nd St.	250	2.00 to 3.00	1.50 to 2.00	3.00 to 4.50	4.50 and 5.00	2.50 to 3.50
OLMSTED Superior Ave. and E. 9th St.	300	2.00 to 3.00	.....	3.50 to 5.00	5.00	.....
STATLER Euclid Ave. and E. 12th St.	1000	2.50 to 6.00	.....	4.50 to 8.00	5.00 to 8.00	.....
STERLING Prospect Ave. and E. 30th St.	150	2.00 to 3.00	.....	3.00 to 4.00	3.50 to 5.00	.....

Air View of Downtown Cleveland Showing Stadium in Foreground

Cleveland offers a great variety of recreation. In summer there is the great park system, swimming in Lake Erie, golf, tennis, American League baseball, and numerous summer resorts. Playhouse Square in Cleveland presents the highest grade of legitimate plays. Twelve thousand seats are available in this theatrical district alone.

Cleveland's Industries

Now as to Cleveland from an industrial standpoint: As is well known it is a city of diversified production, but the backbone of its development has been its convenient location to the rich Lake Superior ore region and the coal and limestone fields of Pennsylvania and Ohio. This happy choice of location has made Cleveland the capital of a great trade empire.

Iron and steel, of course, have been Cleveland's major industries since 1828, when the first smelter was established.

Steel, though the leader, is only one of many industries in Cleveland. It is one of the nation's largest hardware centers. The multigraph machine used in your office was probably made in Cleveland. Only one city in the United States produces more sewing machines. All kinds of products from huge hoisting and conveying machinery to toys and small novelties are manufactured in the city's plants.

Foundry and machine shop products manufactured annually are valued at $127,000,000. The yearly output of motor vehicles, bodies and parts is valued at more than $150,000,000.

Cleveland will have much to show the platers in the way of fine plants. Cleveland is a city of diversified industries, and one of the greatest of these is the manufacture of motor car parts. Many of the plants maintain their own plating facilities. Furthermore they are large and equipped with the latest requirements for rapid production and quality of work.

Convention Plans

The arrangements for the Convention have been capably managed by the following committees:

General Chairman: H. J. TerDoest, 380 Pioneer Street, Akron, Ohio.

Secretary-Treasurer: Wm. E. O'Berg, 2191 West 29th Street, Cleveland, Ohio.

Educational: J. S. Nachtman, 427 Central Parkway, Warren, Ohio.

Hotels and Reservations: J. C. Singler, 3379 West 95th Street, Cleveland, Ohio.

Registration: Wm. E. O'Berg, 2191 West 29th Street, Cleveland, Ohio.

Publicity: E. Steen Thompson, 905 West 10th Street, Erie, Pennsylvania.

Entertainment: Wm. D. Scott, 260 Sunset Road, Avon Lake, Ohio.

Banquet: P. Ross Lyons, 1438 Wagar Avenue, Lakewood, Ohio.

Transportation: R. O. Hull, Grasselli Chemical Company, Cleveland, Ohio.

Bring your problems to Cleveland with the assurance that they will be solved to your benefit and satisfaction. A guest at the last Convention had a problem solved whereby he has been able to cut his costs more per month than the amount of his expenses while attending the Convention.

The program is so filled that there will be only two half-days devoted to plant visitation. All of the men registered will be taken on a trip through one of this country's largest rubber and tire factories.

Alternative trips can be made through Nela Park—the Lamp Research Division of the General Electric Company or the National Carbon Company. It has been agreed that on the trip through National Carbon only such as are not connected with concerns making batteries or radio equipment will be admitted.

Sports

One of the city's finest country clubs has agreed to accommodate the Convention with the exclusive use of their facilities for an afternoon.

Here will be renewed the golf tourney, the annual contest in baseball, with opportunities for many other sports including boating and swimming.

Contest for Metal Industry Cup

The Branches are making the necessary preparations for Branch Exhibits or individual exhibits of some Branch members. Ample space for a very ambitious contest has been provided.

The award for the best exhibit will be the silver cup presented by **Metal Industry.** This cup, which

METAL INDUSTRY CUP
For the Best Branch Exhibit

was won by the Bridgeport Branch, last year, will be retained by the Branch which wins it, for one year. When it has been awarded to any one Branch for the third time, it will become the permanent property of that Branch and a new cup will be provided.

Prize Awards for Papers

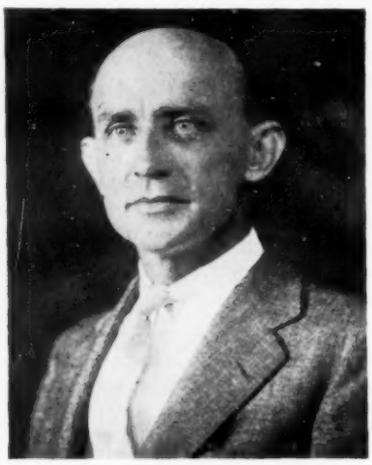
The Society will award two medals this year for papers:

1. The Founders Gold Medal, to be awarded to the author of the best paper by any active member of the Society that is presented to an Annual Convention or to a Branch meeting, and is published in the Monthly Review.

2. The American Electro-Platers' Society Medal to be awarded to the author of the best paper by any person, whether or not a member of the Society, that is presented to an Annual Convention or to a Branch meeting, and published in the Monthly Review.

The following have been appointed to this committee: **Dr. William Blum**, Chairman; **W. J. R. Kennedy**; **Dr. A. K. Graham**; **W. S. Barrows**; **F. C. Mesle**.

T. F. SLATTERY
President, A. E. S.



JOSEPH UNDERWOOD
Vice President, A. E. S.

E. STEEN THOMPSON
Secretary-Treasurer, A. E. S.

List of the Papers to be Delivered

Some Factors Covering the Ductility of Nickel Electrodeposits.
E. A. Anderson, Chief Metal Section, Research Div., New Jersey Zinc Co., Palmerton, Penna.

Calcium Chloride Corrision of Plated Automotive Parts Can, and Should Be Reduced.
Dr. E. M. Baker and **Howard R. Wilson,** University of Michigan, Ann Arbor, Mich.

Summary of Researches on Electrodeposition at the National Bureau of Standards.
Dr. William Blum, Bureau of Standards, Washington, D. C.

Brass Plating for Rubber Adhesion.
Dr. Harry P. Coats, Firestone Steel Products, Akron, Ohio.

The Electrodeposition of Nickel on Zinc.
J. M. Cosgrove, Noblitt-Sparks Industries.

Buffer Action of Certain Chemicals in Relation to pH Control of Nickel Solutions.
Dr. D. A. Cotton, Delco-Remy Corporation, Anderson, Ind.

Process Control and Finishing Costs.
H. L. Farber, Chief Chemist, Westinghouse Electric and Manufacturing Co., Mansfield, Ohio.

Electrodeposition of Zinc and its Protective Value.
George B. Hogaboom, Hanson-Van Winkle-Munning Co., Matawan, N. J.

The Present Status of Electrodeposits of Tungsten from Aqueous Plating Baths.
M. L. Holt, Instructor in Chemistry, University of Wisconsin, Madison, Wis.

Films and Their Relation to Cleaning Before Electroplating.
C. Johnson, Technical Director, Oakite Products, Inc., 22 Thames Street, New York.

The Rapid Electrodeposition of Iron.
Dr. C. Kaspar, U. S. Bureau of Standards, Washington, D. C.

The Properties of Fused Alumina Grain for Polishing.
A. A. Klein, The Norton Company, Worcester, Mass.

Results of the Electroplating Research at Indiana University, Including Plating of Tin, Aluminum, Bismuth, Antimony, Tellurium, Silver, Gold, Lead and Nickel.
Dr. F. C. Mathers, Indiana University, Bloomington, Ind.

W. J. R. KENNEDY,
Editor,
The Monthly Review of the A. E. S.

The Orientive Effects of the Geometrical and Crystalline Structure of the Basis Cathode on the Crystal Structure of Electrodeposits.
Dr. **Walter R. Meyer,** General Electric Company, Bridgeport, Conn.

Resume of Research Committee's Work During the Past Year.
Wm. **M. Phillips,** General Motors Corporation, Detroit, Mich.; Chairman of Research Committee, A.E.S.

Polishing Grain and its Application.
H. R. **Power,** Carborundum Company, Niagara Falls, N. Y.

Comparative Valuation of Modern Finishes.
Leo Roon, Roxalin Flexible Lacquer Co., Elizabeth, N. J.

Stability of Plating Solutions.
Dr. G. Soderberg, The Udylite Company, Detroit, Mich.

Effect of Composition and Structure on Corrosion of Nickel Anodes.
A. G. Spencer, Chevrolet Motor Car Company, Flint, Mich.

Experience in the Plating of Non-Ferrous Metals for Exposure Tests.
P. W. C. Strausser, U. S. Bureau of Standards, Washington, D. C.

A paper to be read by **Dr. M. R. Thompson,** U. S. Bureau of Standards.
Subject to be announced later.

The Effect of Nickel Chloride in Nickel Plating Solutions.
M. Waite, Director of Research, McGean Chemical Co., Cleveland, Ohio.

Metal Rectifiers.
Dr. R. M. Wick, United States Navy Yard, Brooklyn, N. Y.

The Commercial and Practical Aspects of Throwing Power as a Factor in the Character of Deposits.
Donald Wood, Reed and Barton Co., Taunton, Mass.; President, Boston Branch, A.E.S.

Aluminum Reflectors.
Dr. H. K. Work, Aluminum Company of America, Pittsburgh, Pa.

It has been the custom each year to publish a verbatim report of the Convention. Copies of this Report will be prepared in quantity sufficient to supply the subscription list obtained at the Convention. There will be available at the Registration desk, cards for this purpose.

Exhibit of Equipment and Supplies

Booth No.	Name of Company and Product
1	**Seymour Manufacturing Company,** Seymour, Connecticut. Controlled grain anodes.
2	**McGean Chemical Company,** Keith Bldg., Cleveland, Ohio. Besplate, nickel anodes. Plating chemicals of all kinds.
3	**Globe Machine & Stamping Co.,** Cleveland, Ohio. A display of finished metal parts. An interesting exhibit.
4	**Maas & Waldstein Company,** 430 Riverside Ave., Newark, N. J. Metalustre enamels.
6 & 7	**Nickel & Chromuim Products Company,** 250 Park Ave., New York City. Starbright nickel salts. C & A bright chromium salts.
9 & 10	**Norton Company,** Worcester, Massachusetts. Abrasives; their history and development; price-list of abrasive products; alundum ceramic, mosaic tile; Norbide (Norton Boron Carbide); Research and Alundum Polishing Grain; Selection and Handling of glue for the polishing room; what to specify; refractory materials and their uses.
11, 12 & 13	**Udylite Company,** 1651 E. Grand Blvd., Detroit, Michigan. Udylite line switch; ball anode; Udylite Rheostat; Handiplater; plating barrel.
14	**Duriron Company,** Dayton, Ohio. A display of anodes. Something new.
15	**Detroit Rex Products Company,** 13008 Hillview Ave., Detroit, Michigan. Vapor degreasing and cleaning equipment; solvent cleaners.
16 & 17	**R & H Chemicals Department, E. I. DuPont de Nemours & Co.,** Wilmington, Delaware. R & H Chemicals for modern metal treatment; non-inflammable chlorinated solvents; precious metal cyanides for gold and silver plating; operating manual for plating with Duozinc; operating manual for copper, brass, bronze and zinc plating with copper cyanide and zinc cyanide; electrotinning with the sodium stannate acetate bath.
18	**J. C. Miller Company,** Grand Rapids, Michigan. Newest developed chrome anodes. Other types of anodes. A new filtering unit.
20 & 21	**Hammond Machinery Builders Company,** Kalamazoo, Michigan. Rite-speed electric polishing and buffing lathes; variable speed polishing and buffing lathes; heavy duty electric polishers and buffers; ball bearing polishing and buffing lathes.
22	**Oakite Products Company,** 22 Thames St., New York City. How simple changes in cleaning operations offset rising production costs; Oakite News Service (a house organ).
23	**Bruce Products Corporation,** 5712-12th St., Detroit, Michigan. Non-ridge polishing wheel.
24 & 25	**Belke Manufacturing Company,** 947 N. Cicero Ave., Chicago, Illinois. Plating supplies price-list; New Verti-Disc filters; Belke rack insulation; sheet rubber lining.

26 **J. B. Ford Sales Company,** Wyandotte, Michigan.
Metal cleaning with Wyandotte products.

27 **Williamsville Buff Mfg. Co.,** Danielson, Connecticut.
Williamsville high grade cotton buffs.

28 **Zialite Corporation,** 521-5th Ave., New York City.
Zialite solution for nickel plating on zinc and other metals, including aluminum.

29 **Standard Electrical Tool Company,** Evans & 8th St., Cincinnati, Ohio.
Electric buffing and polishing lathes. Also motor on spindle buffing and polishing lathes bench and pedestal types, ¼ to 20 horsepower.

30 & 31 **Carborundum Company,** Niagara Falls, New York.
Aloxite TP Manual of Modern Polishing Practice.

32 **Kelly Plating Company,** 10316 Madison Ave., Cleveland, Ohio.
A demonstration of production plating and method of rust proofing. The last word in mechanical finishing.

33 **N. Ransohoff, Inc.,** W. 71st at Millcreek, Carthage, Cincinnati, Ohio.
Ideal industrial machinery; Ideal tilting ball return burnishing barrel.

34 & 35 **Columbia Electric & Mfg. Co.,** 4519 Hamilton Ave., Cleveland, Ohio.
The latest in plating generators either synchronous or induction built in many sizes.

36 **G. S. Blakeslee & Company,** 19th St. & 52nd Ave., Chicago, Illinois.
Blakeslee patented degreasing machines.

37 **Lasalco, Incorporated,** 2822 LaSalle St., St. Louis, Missouri.
Richards barrel plater; cushioned belt grinder; Utility barrel plater.

38 & 39 **Grasselli Chemical Company,** Cleveland, Ohio.
Hull & Strausser test for determining thickness of cadmium and zinc electrodeposits; Cadalyte, a product and a process of cadmium plating; Kreider centrifugal dryer.

40 & 41 **The Bullard Company,** Bridgeport, Connecticut.
Bullard-Dunn process for cleaning prior to electroplating.

42 & 43 **MacFarland Mfg. Company, Inc.,** 21-03 41st Ave., Long Island City, New York.
Cotton buffs and polishing wheels.

44 **Egyptian Lacquer Mfg. Company,** 1270 6th Ave., New York City.
Lacquers, enamels and thinners.

46 **Electric Products Company,** Cleveland, Ohio.
E-P and Eager electroplating motor-generators and switchboards of the latest design.

48 **Magnus Chemical Company,** Garwood, New Jersey.
Magnus Cleaner-Gard; Magnus hand cleaner, Magnusol.

52 & 53 **F. B. Stevens, Inc.,** 510-3rd Ave., Detroit, Michigan.
Automatic and semi-automatic plating equipment; Mitchell lathes.

54 **Matchless Metal Polish Company,** Glen Ridge, N. J.
Polishing and buffing compounds.

55 **Puro Products Company,** 2602 Payne Ave., Cleveland, Ohio.
Economical, efficient, safety solvents.

56, 57 & 58 **Hanson-Van Winkle-Munning Company,** Matawan, New Jersey.
Hanson-Munning electrolytic bright dip; loxal metal coating; General Catalog of polishing and plating equipment and supplies.

90 **J. Nelson & Son,** 830 N. Wells St., Chicago, Illinois.
Nelson's patented cathode rod containing six outstanding features used with wire hooks or racks.

102 **Kocour Company,** 4724 S. Turner Ave., Chicago, Illinois.
Analytical set for determining thickness of cadmium and zinc deposits; for acid or pH measurements; for chloride in nickel and zinc solutions; for determining free cyanide in cyanide solutions; for determining the sulphuric acid and copper sulphate in acid copper solutions; for the determination of copper in cyanide copper and brass solutions; for chromic acid; nickel comparator; cleaner test set.

104 **Anderson & Sons,** Springfield, Massachusetts.
Name plates, signs, dials, novelties.

105 **Roxalin Flexible Lacquer Company,** Elizabeth, New Jersey.
How good are you at twisting and bending samples of metal?

106 **Lea Manufacturing Company,** Waterbury, Connecticut.
Learok; Learok method of metal finishing; "Nickel-Glo"; buffing and polishing methods; speed calculator for buffing wheels.

Parlor "F" **Branch Society Exhibits.** Exhibits of plated work of the members in competition for the **Metal Industry** Cup.

Main Lobby **Metal Industry,** 116 John Street, New York.
Copies of **Metal Industry, Platers' Guide, Platers' Guidebook** and other plating and finishing literature. **Platers' Guide,** 1 Platt St., New York.

Main Lobby **International Fellowship Club.**
Rest Room. All registrants are welcome.

5 **Exolon Company,** Blasdell, New York.
A display of Carbolon and Exolon. Descriptive literature relating to their application and their economical uses.

45 **B. F. Goodrich Company,** Akron, Ohio.
Korolac plating rack protection.

Full information relative to exhibit arrangements can be obtained from **R. T. Phipps,** Manager of Exhibition, 271 Grovers Avenue, Bridgeport, Conn., or **Harry G. Dean,** Cleveland Representative, Carter Hotel, Cleveland, Ohio.

International Fellowship Club

The Annual Open House of the International Fellowship Club will be held at the Carter Hotel on Monday, June 1. All members and guests are invited.

All registrants at the convention are asked to be sure to read the announcement of the International Fellowship Club which will be enclosed in the program of the convention.

The Grand Opening will be held at 8:30 P.M. with music, dancing, etc. At 10:30 P.M. a buffet lunch will be served.

H. M. CHERRY
President, I. F. C.

JOHN OBERENDER
Vice-President, I. F. C.

T. A. TRUMBOUR
Secretary-Treasurer

Master Electro-Platers Institute Annual Meeting

THE Third Annual Meeting of the Master Electro-Platers Institute of the United States will be held at the Hotel Cleveland on June 1st and 2nd. The Master Electro-Platers Association of the Mid-West will sponsor the sessions jointly with the Institute.

Each organization will hold two separate business sessions during the two-day conclave. All other meetings will be conducted for both groups jointly.

Important problems will feature this conference—problems relating to plans and programs for the ensuing year; the promotion of quality plate, the accrediting of job shops; discussions on pertinent topics such as the operation and maintenance of electrical equipment, the significance of the zinc die cast trend to the job plater, and the function of the trade association in warranting the products of its members. There will be an historical exhibit graphically summarizing the efforts of the Institute during the three years of its existence.

M. M. WISE
President, M. E. P. I.

L. D. JENSEN
Vice-President, M. E. P. I.

PHILIP SIEVERING, JR.
Vice-President, M. E. P. I.

The following Tentative Program suggests the set-up for the National and Regional groups of Job Electro-Platers:—

Monday, June 1, 1936

8:00 a.m. — Registration
9:00 a.m. — Business Session for Members Mid-West Association
12:00 Noon—*Luncheon
1:00 p.m. — Business Session for Members U. S. Institute
6:00 p.m. —*Dinner
7:30 p.m. —*Committees

Tuesday, June 2, 1936

8:00 a.m. —*Discussion—Electrical Equipment, Its Operation and Maintenance
Business Session for Members U. S. Institute
12:00 Noon—*Luncheon
1:00 p.m. —***Discussion**—Zinc Die Castings—Significance to Job Platers
*Symposium of Economies
Business Session for Members Mid-West Association
6:00 p.m. —***Annual Dinner**—The Trade Association's Opportunity to Promote Quality and Warrant the Products of Its Members

*Joint sessions of the U. S. Institute and Midwest Association.

J. B. ESPOSITO
Vice-President, M. E. P. I.

R. J. NAGLE
Secretary-Treasurer, M. E. P. I.

J. J. GERITY
Counsellor, M. E. P. I.

Brazing Fluxes

Q.—I would appreciate knowing the composition of fluxes used in brazing operations.

A.—For brazing cast iron, a flux of black oxide of copper, CuO, is good because it oxidizes the carbon and causes a deep penetration of copper, which takes the molten spelter readily. This is the same oxide of copper used for the plates in the Edison primary batteries. Make a paste with the oxide and water or vaseline and apply to the work with a brush. Borax when calcined makes a useful flux for steel, brass and copper. The calcining process consists of heating the crude borax in an iron pot to redness to drive off the water of crystallization. Then powder the porous mass. Clean silica sand is also serviceable for a flux when treating scaled iron or steel, as the scale and sand unite to form a liquid covering. Other fluxes are clay, powdered glass of the ordinary bottle and window varieties (the leaded or flint glass will not do), sal-ammoniac, hydrochloric acid, phosphoric acid, zinc chloride and combinations thereof. The zinc chloride is made by dissolving scrap zinc in hydrochloric acid until boiling ceases, and diluting double with water.

By adding about 1/3 sal-ammoniac to the chloride and diluting with alcohol, a good general purpose flux can be made which will not rust steel.

Chloride of tin mixed with starch paste forms a good flux for low melting non-ferrous metals.

—W. B. Francis.

Aluminum Withstands Flood

Furniture owners were heavy losers in the recent flood at Pittsburgh. Some fared better than others—among them the owner of the chairs and tables shown above, made of aluminum. After the flood receded the clerks simply wiped off the mud and put them back in place.

Aluminum Chairs After the Flood

Heat Treatment of White Golds, Platinum, Etc.

Q.—We are having difficulty in connection with our white golds, and would like to know the proper alloying, casting, and annealing temperatures for them. We use 10-k, 14-k, and 18-k, made up with nickel. Do you recommend a double heating in alloying? What about crucible materials, etc.

We also use 10% iridio-platinum; what flux should be used in annealing it?

A.—The temperature at which nickel-golds become molten is noticeably higher than that at which yellow or red golds of the same karat show the same fluidity. Each particular alloy—that is, each formula—has its own individual melting point, or rather melting range, and since you do not give the formula of your alloys, we cannot give exact figures. However, here are several points applying to the common nickel-gold alloys, and probably they will apply to what you are using.

When heated, these alloys do not melt sharply at a definite point, after the manner of pure gold or pure nickel; they first become pasty or mushy, then, at perhaps 30 or 40 degrees hotter, they become fully liquid. This explains the phrase "melting range." Its extent will depend upon the exact composition of the individual alloy.

Yes, a double heating when alloying is customary. One authority, Frolich[1], advises you to melt the nickel first, using plenty of boric acid crystals as a flux, then add the gold a little at a time, keeping the furnace hot enough to bring about complete melting. Next, let the melt cool to about 1100 to 1065 degrees C., (2012 to 1949 deg. F.), and then deoxidize with a little magnesium wire. Capillon[2] advises phosphor copper as a deoxidizer, instead of magnesium. Next, add the proper quantity of zinc, stir with a carbon (not iron) rod, and add another bit of magnesium wire, and pour.

The pouring temperature should be at least 150 to 250 degrees F. hotter than the upper limit of the melting range. Capillon found that still higher pouring temperatures did no harm other than cause a probable loss of zinc; it appears that a high casting temperature has little or no effect on the rolling properties or the ductility of metal that is properly annealed. Of course if an alloy is poured at too low a temperature, the metal may solidify before it has a chance to fill out the mold, and that gives a bad ingot.

Other authorities advise you first to melt the gold, then add a nickel-copper alloy, or a nickel-copper-zinc alloy, previously prepared, in small pieces.

In either case, it is customary to roll out the bar, cut it up, and remelt.

Graphite crucibles are largely used, in spite of the fact that some experts claim that the sand crucible is better; the idea is that nickel forms a carbide when in contact with the hot graphite, and that this may cause brittleness.

A few melting ranges: A typical 14-k white gold has a melting range of 1613 to 1723 degrees F. An 80% gold, 20% nickel alloy begins to melt at about 1742 deg. F.

Doubtless you have heard that white golds are much more susceptible to heat treatment than are the other gold alloys. This is true, but it applies more to annealing than to casting temperatures. Variations in annealing, as to its temperature, its duration, and the rate of cooling, all have important effects upon hardness, ductility, etc., and even in some cases on the color of the alloy. These are different for different formulas or compositions, and it is here that most of the trouble arises.

Annealing should be done at a temperature higher than that suitable for yellow gold; 750 to 800 deg. C. (1382 to 1472 degrees F.) is customary, followed by cooling in air. Slow cooling means a softer alloy; quenching, or quick cooling, means increased hardness.

Wise[3] gives some very interesting figures on the effect of different rates of cooling on the ductility (elongation) of white gold alloys. For instance, he cites an 18-k white gold, (gold 75%, nickel 16.5%, zinc 5%, copper 3.5%) which was annealed at 1382 degrees F., then allowed to cool in air; when tested it showed an elongation of 47% in 2 inches. It was then heated again to the same degree, and allowed to cool slowly in the annealing furnace, when it was found that its elongation had dropped to only 2%.

So-called age-hardening, which means heating for some time at a lower temperature, also has pronounced effects.

The favorite flux for white golds either when melting or annealing, is boric acid. This has similar properties to the familiar borax, except that it melts at a higher temperature, and therefore does not become too fluid at the temperatures employed. When pouring, it is a good idea to thicken the flux slightly by adding a little powdered glass, and push it to one side with a graphite rod, to keep it from running into the ingot mold.

Iridio-platinum does not require any flux when being melted or annealed, as it does not tarnish. Annealing at about 1200 deg. C. or 2191 F. makes for improved ductility.—**Jewelry Metallurgist.**

[1] W. Frolich. Metal Industry (British), 1932, Vol. XII, p. 28.
[2] Edward A. Capillon. T. P. 282, Inst. of Metals Div., Amer. Inst. Min. & Met. Engrs., 1930, p. 12.
[3] E. M. Wise. Transactions Amer. Inst. Min. & Met. Engrs., Inst. of Metals Div., 1929, p. 394.

Specifications for Metals

File These with the Brass Founders' Manual

Specifications for Phosphor Copper

OF THE AMERICAN SOCIETY FOR TESTING MATERIALS

	Phosphorus Minimum Per Cent	Phosphorus Plus Copper Minimum Per Cent	Iron Maximum Per Cent
Grade A	14.0	99.75	0.15
Grade B	10.0	99.75	0.15

Specifications for Aluminum

OF THE AMERICAN SOCIETY FOR TESTING MATERIALS

	Aluminum Min. Per Cent	Copper Max. Per Cent	Iron Max. Per Cent	Silicon Max. Per Cent	Total Impurities Max.
Grade 99.5	99.5	0.10	...	...	0.5
Grade 99.0	99.0	0.25	...	...	1.0
Grade 98.5	98.5	0.45	...	...	1.5

Electrogalvanizing Round Wire

History, Developments in the United States, Technical Facts and Considerations, Effect of Electrogalvanizing on the Physical Properties of the Wire Appearance and Finish, Cost, etc., as Shown by European Practice.

By ARNOLD WEISSELBERG

Consulting Engineer, New York

IF ONE had inquired a few years ago about electrogalvanized round wire, he would have learned to his surprise that although extensively used in Europe, this product was not being made in the United States. The fact that flat wire, strip and pipe could be had so galvanized added to the surprise and begged the question as to why the steel mills in this country had stopped at round wire. Since then electro-galanized wire has made its entry and within a short time has become an established staple product.

History of Round Wire Galvanizing

The history of this manufacture is mostly a record of fruitless attempts to deal with a problem which had taxed the ingenuity of the inventors. More interesting still is the fact that the cause of the difficulty was known from the earliest beginning.

The earliest record on the subject is the patent granted to Fox in Britain in 1879 (Fig. 1). It never attained the commercial stage, a fate in which most of the subsequent patents shared. The efforts of

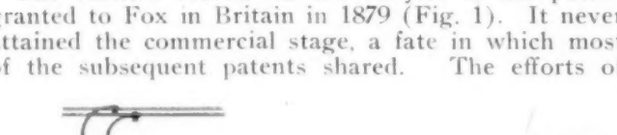


Fig. 1. Drawing From British Letters Patent Granted to Fox in 1879. First Drawing on Record of an Electrogalvanizing Plant for Round Wire

those engaged at that time in improving the art seemed to center around the reduction in size of the equipment. On account of the low current densities employed, the length of the tanks became prohibitive when operating anywhere near the speeds occurring in hot galvanizing. Hence the persistent attempts to electro-galvanize wire by winding it on reels or drums immersed in the plating tank. This answer to the problem introduced new difficulties such as the arrangement of the anodes to insure a uniform coating. In this class belong the patents of Wallace, Lake and Rawson (Figs. 2 & 3). By the end of the last century three methods had attained a fair measure of commercial success. Sherard Cowper Coles was forging ahead in England, Wagner in France, and Herman in Germany. In the United States a process had been developed by the U. S. Electro-Galvanizing Co., which is now the U. S. Galvanizing and Plating Equipment Corp. In the meantime, a number of patents had been issued on various compositions of electrolytes for zinc plating. Only very thin coatings could be obtained, fairly adhesive when great care was exercised in the manufacture. Nevertheless tests on samples produced in still baths in the laboratory held out great promises for this type of wire if only the difficulties encountered in continuous manufacture could be overcome. The English Post Office in 1894 was apparently very much impressed with the results of labora-

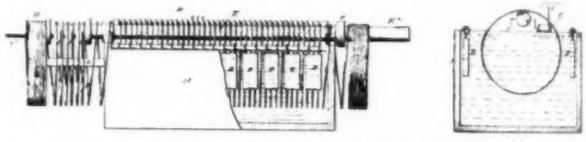


Fig. 2. Drawing From British Letters Patent Granted to Lake in 1881. This Scheme is Typical of Attempts to Reduce the Size of the Plant by Winding the Wire Through the Bath

tory tests on galvanized telegraph wire which showed that the cold galvanized wire was superior to the hot galvanized. This question of superiority of electrogalvanized coatings on wire has come up, ever since, every few years. The claim that for the same thickness the electrically deposited zinc affords greater corrosive protection, however, never went unchallenged

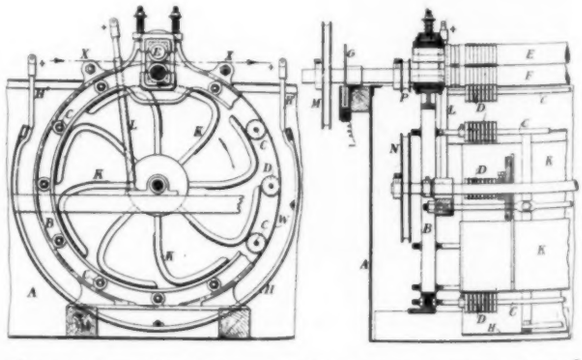


Fig. 3. Drawing From British Letters Patent Granted to Rawson in 1896. This Shows a Different Scheme of Coiling the Wire in the Bath in Order to Reduce the Size of the Plant

by those who represented the hot galvanizing interests. Nor was the commercially produced product so satisfactory as to aid the cause of those who propounded electro-galvanizing. In England and the United States, the interest seemed to peter out. On the continent, however, the Herman process seemed to be making slow but definite progress. The coatings were thin, only 0.1 to 0.15 oz. per sq. ft., but they adhered well and the results were consistently uniform. The firm of G. Langbein & Co., which later became the Langbein-Pfanhauser Works, began installing one plant after another, until at the beginning of the World War, there were 35 installations in operation scattered all over Europe. By that time, coatings up to .3 oz. per sq. ft. were being obtained and the number of wires per galvanizing unit had increased to 52. Heavier coatings than .3 oz. did not appear until after the war, but the demand for heavier coatings than 0.5 oz. seemed limited, since the opinion prevailed that such coatings were equal to those of hot galvanized wire of twice the thickness. Several telephone and telegraph companies on the continent began specifying electro-galvanized wire. Also manufacturers of wire products began showing a preference for the electro-galvanized product. Interest in electro-galvanized wire was therefore revived in England after the war and we find several firms there making heavy investments trying to develop a wire galvanizing process. Outstanding among them are Craddock of Wakefield and Hill of Cambran. All proved lamentable failures, both from a mechanical and financial point of view. In 1925 the latter plant was taken over by Whitehead, Hill and Co., who after a few years of additional development and improvement succeeded in producing a commercially salable product. To the writer's knowledge it is still the only plant in England manufacturing electro-galvanized wire. This plant is of the single wire type using an upper and lower drum over which the wire winds.

On the continent the increasing demand for electro-galvanized wire resulted in the erection of more plants. By 1930, the Langbein-Pfanhauser Works completed the erection of the 50th plant. Some of these were designed to coat wire 1.0 oz. per sq. ft. but the majority of plants still continued to produce coatings of less than 0.5 oz. per sq. ft. The reason for this may be found in the cost. Below this weight electro-galvanized wire apparently could compete with hot galvanized wire. Above it electro-galvanized wire had to command the price of a quality product for which, however, there was only a limited market. Toward the end of the last decade, a 1.0 oz. coating was therefore considered the limit.

Developments in the United States

In the United States developments took a different course. Electro-galvanizing had been confined to flat wire and narrow strip. The thickness of the coating was limited to 0.3 oz. per sq. ft., and to produce such coatings by hot dipping followed by wiping would be much more expensive than electro-galzanizing. For such thin coatings, needing comparatively little adherence to the base in order to meet the requirements, the older methods of electro-galvanizing were adequate. For heavy coatings on flat wire and strip, electro-galvanizing would probably be at a disadvantage due to edge growth in plating on the one hand and the ability to produce such coatings satisfactorily and more economically by hot dipping on the other. The advantage of the electro process in providing wire screening with a thin protective zinc coating is quite obvious. It is also obvious that the hot dipping process would not be suitable for galvanzing chains. Electro-galvanized conduit piping is coated only with 0.3 oz. which is quite satisfactory for indoor use and stands bending much better than dipped coatings of equal thickness.

The test specifications that zinc coatings on round wire must meet are, however, an entirely different matter. The wrapping test on a mandrel equal the wire diameter called for a much stronger bond between coating and base than required in the case of the other products. In addition, the electro-galvanizing methods known had the fault that they deleteriously affected the physical properties of the wire, a matter of considerable import in round wire. With the advent of heavier coatings, the electro-galvanizing of wire presented an increasingly difficult problem.

There were repeated attempts even before the World War to produce electro-galvanized round wire, but the results were far from satisfactory and brought this product into disrepute in this country.* As recently as 1932 the writer found that a strong opinion prevailed among the majority of manufacturers and users that electro-galvanizing impairs the physical properties of the base metal especially high carbon steels, and that electro-galvanized wire was too expensive to produce, and that the coating could not be made to adhere well.

On the other hand, hot galvanizing had undergone steady improvement. The brittleness of the ferrous zinc layer forming adjacent to the base had been reduced so that the coatings would be more ductile and adherent. In 1930, Hippensteel, Horgman and Farnsworth presented a paper entitled "Observation of the Outdoor Atmospheric Corrossion of Protective Zinc Coatings," stating that it is the weight of the zinc coatings rather than the method by which it is applied which determines the resistance to corrosion, providing it is uniform and adherent. This paper, in the writer's opinion, marked the turning point in the development of electro-galvanized wire in the U. S. At first it was detrimental to the electro-galvanizing cause, because it denied the claim that the plated coating being pure zinc is superior and resists corrosion better than hot galvanizing. Apparently all that remained to be claimed for electro-galvanizing was more uniform thickness and freedom from the heating effect of the hot spelter which made the latter unsuitable for tempered or high carbon steel wire. However, as it actually happened, this report turned out to be a boost for electro-galvanizing. The report made it quite obvious that the life of the wire would increase in the same proportion as the weight of the coatings. Assuming the mechanical and economical question solved, much heavier coatings could be produced by electro-galvanizing than possible with hot galvanizing. Coatings of 1.2 oz. per sq. ft. appear to be the limit for the latter.

The Bethlehem Steel Co. must be credited with the vision of a future market for electro-galvanized wire with zinc coatings heavier than produceable with hot galvanizing. It was before the above mentioned report appeared that Bethlehem Steel became interested in electro-galvanized wire, influenced probably by developments in Europe. Experiments with the process invented by U. C. Tainton began in 1928. By 1932 the difficulties appear to have been ironed out and the product known as Bethanized wire was placed on the market in 1933. In Europe, too, the Langbein-

* In April, 1921, the Air Service Information Circular on Aviation published the results of an investigation to correct the prevailing erroneous opinion that the "wire was so embrittled by electro-galvanizing as to render it unsatisfactory for use." To the contrary it stated that "zinc plating has a tendency to increase fatigue resistance."

Pfanhauser process had undergone some major improvement making it possible to produce heavy strongly adhering zinc coatings on a commercially economical scale. As the electro-galvanized wire is coming into wider use, new advantages are found for it and it seems a safe prediction that its application is in the ascent.

Technical Facts and Considerations

Insufficient adherence seems to be the chief cause of the repeated setbacks and financial failures which marked the development of electro-galvanized wire. That this was due to the inadequate preparation of the wire seems to have been recognized by some from the very beginning, as revealed in an article by M. P. Wood, in the Scientific American Supplement of Jan. 19, 1895 in which he stated that to "thoroughly clean the surface to be coated is found to be the principal difficulty in the application of any electro-chemical process for zinc." Apparently this requirement was not fully appreciated judging by the fact that subsequent efforts to improve the process centered mainly in the plating end of the process. When heavier coatings came in, it was not only necessary to find ways and means to reduce the plating time, but also to devise still better cleaning methods lest the coating should fail on test.

The difficulty of properly cleaning the wire will be more readily realized if one considers the following:

(1) that quite different from still plating, in a continuous process the time within which the cleaning has to be completed is very short, only a fraction of a minute in commercial operation.

(2) that the cleaning method must be of a very stable character to insure uniform results within the short time at disposal.

It is this last mentioned requisite that has been the despair of the experimenters. The cleaning method employed would operate satisfactorily only to break down completely after a relative short period of operation. Many patents have been granted on the subject. Some of the methods disclosed did not prove satisfactory when put to test for conditions such as the application of heavy coatings imposes. Tainton hit upon an elegant idea for obtaining stability when he suggested to electrolytically clean the wire in a fused caustic soda and soda ash bath. The bath is kept heated in a lead pan at a temperature of more than 1200° F. The nascent metallic sodium deposited from this bath on the wire, which is made the cathode, having a high affinity for oxygen, reduces the iron oxide on the wire surface to pure iron. The sodium is thereby returned to the electrolyte. This makes for stable conditions. Practical operation proved, however, that this cleaning method need be followed by still another electrolytic cleaning method employing an acid solution to insure complete removal of all of the oxide and other impurities existing on the wire surface. Another cleaning method which has proved successful for preparing round wire for subsequent application of heavy zinc deposits is that developed abroad by Langbein-Pfanhauser. Information from European wire mills licensed to use this process is to the effect that it is both simple and economical, in operation. The foreign patents on it only disclose an acid solution and a current density of 200 amperes per sq. ft., which makes it obvious that the principal information on which the success of this method hinges, has been withheld. The moderate temperatures at which it operates places it at an advantage where high carbon and spring wire are to be galvanized, although the high temperatures of the Tainton bath are not without advantage when it is desired to combine, when feasible, the cleaning with the annealing operation.

No special method of cleaning is disclosed in the Parker Process used by Whitehead, Hall & Co., Ltd. Unsatisfactory cleaning has been the chief source of trouble at this plant. Many of the difficulties have been overcome, although it is still not regarded suitable for high quality wires or severe cleaning conditions, if the physical properties of the wire must be preserved. Of the better known domestic electroplating engineering firms such as Hanson-Van Winkle-Munning, U. S. Galzanizing and Plating Equipment Co. and Meaker the writer has no definite information as to whether they have developed a satisfactory cleaning process for the round wire, because of the absence of commercial installations.

As far as the deposition of the zinc is concerned, none of the commercial processes can lay claim to novelty of ideas. The zinc sulphate electrolyte may vary in composition from one process to another as to addition of agents with the view of improving the throwing power or brightening of the deposit, but basically they are the same. The use of lead anodes in connection with regenerative electro-zincing with recirculating electrolyte as employed in the Tainton process, in which the zinc is deposited directly from the concentrated ore, dates back to 1895 as disclosed in a patent granted to Sherard Cowper Cowles. Only the method of purifying the solution has undergone substantial improvements and silver-lead anodes have been substituted for the lead anodes. The advantage of dispensing with the replacement of anodes is offset by the shortcoming that higher voltages (10V) must be employed than required with zinc anodes (6V). It is generally conceded that a higher voltage does not yield as tough a deposit as obtainable with a lower voltage and this is especially true with heavy deposits. Also the electrolyte must have a much higher acid concentration.

An outstanding fact in the new methods of electro-galvanizing of wire is the tremendous increase of the current densities. Whereas current densities of 200 A/sq. ft. were considered high a few years ago, double and triple that are customary. Only by this increase in current density could the electro-galvanizing of heavy zinc coating on wire become a commercial success. In the Tainton Process, current densities of even more than 700 A/sq. ft. are employed. The use of such high current densities makes it more difficult to obtain dense and pore free deposits. Both the heat and hydrogen liberation at such high current densities are tremendous and the tendency of formation of porous deposits is accordingly increased. One of the difficulties thus created is the more intensive washing required after galvanizing to remove the last traces of acid from the pores, otherwise corrosion will start in these pores. The necessary after treatment of the wire to remove the unsightly appearance of the deposit should also be charged against the use of such high current densities.

Effect of Electro-Galvanizing on the Physical Properties of the Wire

I have already mentioned how serious the deletorious effect on the physical properties of the wire was, in the older methods of galvanizing. Especially high carbon steels, in the words of a report to the Eng-

lish wire manufacturers "were rendered worthless." This no longer applies. A properly electrogalvanized hard drawn wire of any carbon content will have the same physical properties with respect to torsion and bending as before galvanizing. A typical analysis follows:

Type of Wire:	No. 9 ga; 0.1 C Bessemer Before Galv.	Steel; 1.5 oz. zn/sq. ft. After Galv.
Bending	7, 7, 7, 6, 7, 5,	6, 7, 7, 6, 7,
Torsion	1, 1, 1, 1, 1, 1	1, 1, 1, 1, 1,
Tensile M#/in.²	122 ; 119	115 ; 116

Type of Wire:	No. 11 ga.; Spring Wire Before Galv.	1.01 oz. zn/sq. ft. After Galv.
Bending	6, 5, 5, 5, 5, 6, 5, 5	5, 6, 5, 6, 5, 6, 6
Torsion	15, 15, 16, 15, 16	16, 16, 16, 16, 15
Tensile M#/in.²	198 ; 200	195 ; 198

Type of Wire:	Before Galvanizing	No. 14 ga.; Annealed; 0.13 % C.; 1 oz. zn/sq. ft. After Galvanizing	1 yr. After	4 yrs. After
Bending	12, 12, 16, 13, 12, 12	13, 13, 11, 10, 12	12, 11, 12, 11	10, 10, 11, 12, 12
Torsion	40, 50, 43, 43, 44	37, 37, 35, 40	40, 41, 37, 37	40, 38, 39, 40, 42
Tensile M#/in.²	50.5, 51, 51	not tested for	62.5, 62	59.5, 60

Type of Wire:	Before Galvanizing	No. 12 ga.; Annealed; 0.04% C.; 1 oz. zn/sq. ft. After Galvanizing	1 yr. After	4 yrs. After
Bending	22, 26, 25, 26	19, 22, 22, 19, 21	16, 19, 19, 13, 16	14, 15, 16, 13
Torsion	96, 67, 67, 84, 94	68, 68, 68, 67	61, 48, 45, 57	65, 71, 60, 62
Tensile M#/in.²	33.2, 33.2	not tested for	40.4, 40.4	39.2, 38.6

Kind of Wire:	Ga.	Diam. Ins. Before	Diam. Ins. After	Zn., Oz. sq. ft. Before	Zn., Oz. sq. ft. After	Tensile lb. sq. in. Before	Tensile lb. sq. in. After
Bessemer hd	8	.1665	.1653	.95	.92	95,000	96,700
Bessemer Ld. An.	8	.1653	.1634	1.015	.925	64,900	66,850
Tel. Stock hd.	12	.1102	.1075	.98	.95	101,000	102,400
Tel. Stock Ld. An.	12	.1095	.1075	1.04	.995	81,600	65,400

Annealed wires behave differently. Age, as it is well known, has an effect on annealed wire and what causes this effect is also responsible for changes occurring in the physical properties of the wire that is electrogalvanized. Diffusion of hydrogen into the metal is given as the cause. Quite different though from hot galvanized wire aging of electrogalvanized wire apparently results in a partial return to its initial properties as one would conclude from the following tests, which are by no means conclusive.

The increase in tensile strength over that originally possessed by the bare wire should be attributed to the zinc coating. The loss in bending and torsion property is not of the order that would meet with objections.

Appearance and Finish of Electrogalvanized Coatings

The appearance of the coating as it leaves the galvanizing plant is greatly affected by the composition of the bath and the current densities employed. Under satisfactory conditions a silvery gray matt finish is obtainable which is quite pleasant to the eye. While not as bright as wiped hot galvanized wire, it is of a much more lasting nature, i.e., it will not darken like the latter will when exposed to the atmosphere. An appearance as bright as that of wiped tinned wire can be had if desired by an additional operation inserted ahead of the take up reels. Recent improvements permit of carrying out this operation without interruption from coil ends and with very little change to the wire dimensions as borne out by the following comparison before and after the brightening operation:

Cost of Electrogalvanizing Round Wire

As stated before, European experience taught that up to 0.5 oz. per sq. ft. the cost of electrozincing came higher than for hot galvanizing and need therefore command a higher price. Since power costs make up a great portion of the total cost of electrogalvanizing and the cost of power is much higher in Europe than on this continent this situation is well founded. With low power rates the cost may compare favorably for a four dip wire as well, especially in the heavier gauge range. For heavier coatings, of course, electrogalvanizing does not have to compete with hot galvanizing as it has the field to itself.

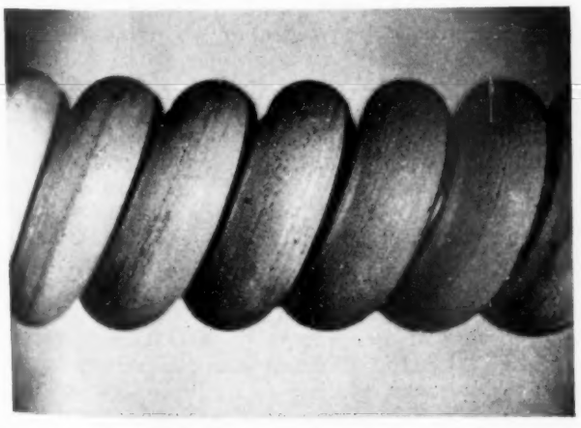


Fig. 4. 8 Ga. High Carbon Hard Drawn Wire; 1.12 Oz. Per Sq. Ft. Magnified 5 Dia. Note Smoothness of Deposit

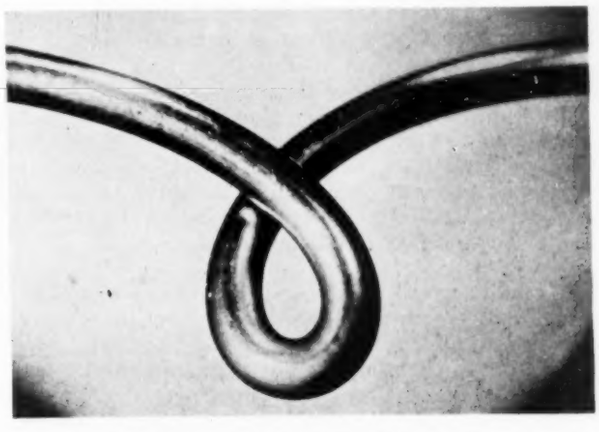


Fig. 5. 12 Ga. Annealed Wire. 0.5 Oz. Per Sq. Ft. Magnified 5 Dia. Bright Finish

The cost will obviously vary with the production, the wire gauge and thickness of deposit. An idea as to these costs, though, for galvanizing from anode may be gained from the following table for 12 Ga. wire with .6 oz. and 1. oz. deposit, based on 25 tons actual production in 24 hours.

	0.6 oz./sq. ft.	1 oz./sq. ft.
Power (including drives) @ 5 mills per KWH	$35.	$50.
Zinc @ 6c per lb	105.	174.
Labor @ 65c per M-Hr.	68.	78.
Chemicals, steam & water, maintenance & repair, pickling included	42.	48.
Total	$250.	$350.
per Ton net bare wire	10.	14.
per Ton galvanized wire	9.70	13.15

These cost figures show to what extent the cost of power influences the total cost. As the cathode efficiency for zinc is 100% and the zinc losses negligible, (as only that is wasted which is lost through drag out from the solution), the power for plating and the zinc requirements can be accurately determined and are the same for all methods.

Cost figures have a way of obscuring intangible gains and therefore the advantages of electrogalvanizing of round wire are summed up:

Operation Advantages:

(1) The zinc economy is maximum. There are no zinc losses.

(2) There are no losses during shut down.

(3) The plant can be started up and shut down quickly.

(4) The thickness of the coating can be accurately controlled.

(5) The operation of the plant is clean, pleasant and not health impairing.

Quality Advantages:

(1) The coating is very uniform in thickness.

(2) Coating of more than 4 dips can be produced. Due to uniformity of coatings .2 oz. per sq. ft. can be allowed for 1 dip.

(3) Does not affect physical properties of the wire. Suitable for spring steel.

(4) The coating of pure zinc is highly ductile and adheres perfectly so that it will neither peel nor crack when wrapped around its own diameter.

(5) The coating surface is smooth, an advantage in fabrication.

(6) Defects of the wire are revealed.

Bethlehem Process of Electrogalvanizing Round Steel Wire

On April 16th, the Bethlehem Steel Company held a formal opening of its new mill for electrogalvanizing round wire at Johnstown, Pa. This process called, "Bethanizing" is a revolutionary development in electrogalvanizing, invented by U. C. Tainton, president of the Tainton Metallurgical Corporation, Baltimore, Md., consultant to the Bethlehem Company.

The process, according to Mr. Tainton is almost exactly the same as that used for zinc recovery by the Sullivan Mining Company, Kellogg, Idaho, except that the zinc is plated directly onto a steel surface instead of an aluminum cathode from which it can be detached and melted down into ingots. The raw materials used consist of roasted zinc concentrate carrying 50 to 60 per cent zinc and a number of other elements. The roasted zinc ore is agitated with the return electrolyte coming back from the cells in which the bulk of the zinc has been extracted.

The zinc is leached from the concentrate and filtered separating the pulp from the liquor. The clear solution now contains zinc sulphate and a variety of other metals, such as iron, lead, gold, silver, etc., as well as silica. The clear solution is pumped to storage tanks, drawn to the purification agitators where it is treated with finely divided zinc dust at about 75 degrees C. This precipitates cadmium, copper, indium, gallium, thallium, tellurium and part of the nickel and cobalt. The precipitated metals are again removed by filtration and the solution, consisting essentially of zinc sulphate together with some manganese, magnesium and calcium is ready for electrolysis. The concentrated neutral solution carries about 220 grams per litre of zinc at a speed which will correlate with the amount of zinc being taken out of the solution so that the electrolyte is maintained at 200 and 270 grams per litre.

It is absolutely necessary that the steel surface be free from all foreign matter such as grease, scale, rust or even spongy metal. It should contain no occluded hydrogen. For this reason the steel is treated, before running through the solution, with a strongly electronegative element, such as sodium, which will attack and combine with any non-metallic substances on the surface, but will not attack the metal itself. The steel wire is the cathode in a fused salt such as sodium hydroxide. The nascent sodium evolved combines with oxygen, sulphur, phosphorus, etc.

The plant at Johnstown comprises two plating tanks, each 110 ft. long taking 40,000 amperes at normal load. Each tank takes 12 wires traveling from 50 to 200 ft. per minute depending upon the thickness of coating desired, size of wire, etc. Current densities vary from 700 to 2000 amperes per sq. ft. The insoluble anodes consist of an alloy of lead and silver highly resistant to the solution.

The process is fully automatic, the uncoated drawn wire coming from the reels, passing through fused caustic pots and washing tanks and then to the plating tanks. The wire emerges from the plating solution with a matte surface which is polished by drawing through dies which, at the same time, render the deposit more dense.

Outstanding features of this installation are the special homopolar generators of 40,000 amperes capacity, built by the Hanson-Van Winkle-Munning Company, Matawan, N. J.

An important advantage of electrogalvanized wire over hot dipped is the fact that any desired weight of coating can be applied under close control.

Methods for Determining the Thickness of Zinc Coatings

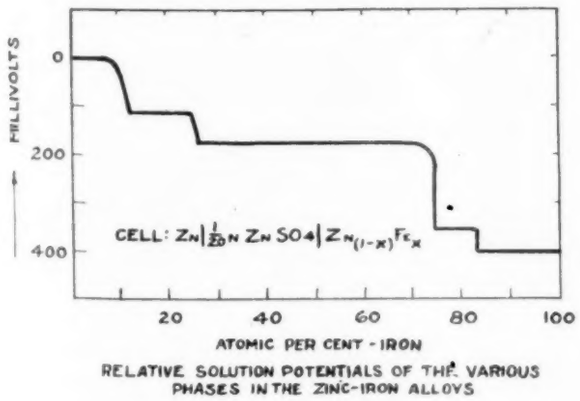
Comparisons of Various Methods: Drop Test, Strip, Microscopic Measurement, Preece Test Analysis; for Electrodeposited, Sherardized and Hot Galvanized Coatings.

By WALTER R. MEYER

Electrochemist, General Electric Company, Bridgeport, Conn.

THE present shortage of cadmium has focussed the attention of industry upon zinc as a substitute for cadmium particularly where the metallic coating must offer both corrosion resistance and good appearance to the basis metal. The use of recently developed bright zinc plating solutions enables the production of zinc deposits which are comparable in appearance to bright cadmium electrodeposits. Because, however, the commonly applied thicknesses range from only .0002" to .001" these deposits are used solely where medium resistance to corrosion is desired. Recently completed atmospheric corrosion tests have shown that zinc has as good or better corrosion resistance than cadmium when exposed to marine, industrial, or rural atmospheres. The life of zinc or cadmium coatings approximately .0002" thick, ranges from one half to three years, and when longer resistance to corrosion is desired, heavier electrodeposits, hot-galvanizing, or sherardizing must be employed. The life of a zinc coating when exposed to atmospheric corrosion is almost a linear function of the total weight of the zinc in the deposit although this may vary under certain corrosive conditions due to film formation. The corrosion resistance of hot-dipped zinc coatings may vary from a linear function of the weight of zinc, because of various iron-zinc alloys with different solution potentials[1] (see Fig. 1).

FIGURE I



RELATIVE SOLUTION POTENTIALS OF THE VARIOUS PHASES IN THE ZINC-IRON ALLOYS

Because the total weight of zinc in the coating determines the corrosion resistance of the coating, a study of the accuracy of the Preece test[2], antimony chloride-hydrochloric acid stripping test[3], microscopic measurement, and drop tests was made by comparing the results with the total zinc determined analytically. Zinc electrodeposits, hot-dipped and sherardized coatings were measured.

Electrodeposited Zinc Coatings

Electrodeposited zinc coatings consist almost entirely of free zinc without any alloyed iron. Excellent correlation was obtained between microscopic thickness determinations, the antimony chloride-hydrochloric acid stripping test, and the Hull-Strausser[4] drop test. The Preece test gave good correlation with thicknesses above .001" but for thicknesses below this value the percentage error made it too great for use other than for the determination of the distribution of the coating. The temperature of the solution and work, the concentration of the test solution, and the degree of agitation of the solution must be carefully controlled for reliable results from the Preece test. The Hull-Strausser drop test depends upon a constant reaction velocity between the test solution and the zinc and this condition is maintained when testing electrodeposited zinc because of the presence of only one phase of zinc. This test is accurate within 15%. High results may be obtained when microscopic measurements are made if care is not taken to prevent the zinc from smearing at the edges. A .0005" coating of chromium applied directly to the zinc before the specimen is mounted for polishing will enable the sharp edges to be maintained.

The method of A. Glazunov[5] which involves anodic dissolution of the zinc coating in a zinc sulphate solution at a constant current density may be used to determine the phase structures in hot-galvanized deposits but it is not particularly advantageous for determining the thickness of single phase electrodeposited zinc. The small area exposed to anodic dissolution makes this method more suitable for galvanized wire or strip but it obviously is not as suitable for determining the thickness over a large area as are the other methods previously mentioned.

The single phase structure is responsible for the excellent correlation obtained between the various methods for determining the thickness of electrodeposited zinc. Zinc deposited from alkaline plating solutions has a very fine grain size which renders microscopic measurement of grain size almost im-

[1] W. H. Finkeldey—The Microstructure of Zinc Coatings—The New Jersey Zinc Co. Research Bulletin, 1927, page 7

[2] E. C. Groesbeck and H. H. Walkup—Bureau of Standards Journal of Research—Vol. 12, 1934, page 785.

[3] A.S.T.M. Standards Part I Metals—1933, page 318.

[4] R. O. Hull and P. W. Strausser—Monthly Review, American Electro-Platers' Society, Vol. 22, 1935, page 9.

[5] A. Glazunov—Transactions, Faraday Society—Vol. 31, 1935, page 1262.

possible. The deposits obtained from acid solutions, especially when addition agents are not present, are much coarser grained so that the grain structure may be easily seen under the microscope. The deposits studied by the writer showed an oriented grain structure with the direction of the long crystal axes parallel to the surface of the basis metal. Figure (2) shows the oriented structure obtained by depositing zinc from

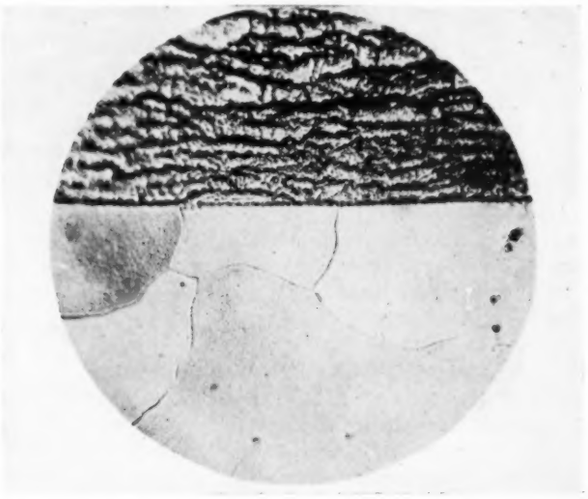


Fig. 2. Electrodeposited Zinc on Cast Zinc. Mag. 500X. The Electroplated Zinc Has the Oriented Structure and Was Deposited at 5 Amps./Sq. Ft. From an Acid Solution

an acid solution at 5 amperes per square foot. The large-grained basis metal is cast zinc which did not have an orientive effect upon the electrodeposit even though it was etched to expose its normal crystal structure previous to being electrogalvanized.

Sherardized Coatings

Sherardized coatings consist almost entirely of a zinc-iron alloy which reacts with the various test solutions with a slower velocity than the electroplated zinc. The zinc-iron alloy or alloys cause a premature end-point with the Preece solution and this method of testing sherardized coatings proved to be very unreliable. The microscopic measurements give high results because of the presence of iron in the zinc coating but if this is taken into account, an accuracy within 10% may be obtained. Considerable difficulty was experienced in preparing sherardized coatings for microscopic examination because they are brittle and break away during polishing. Chromium plating previous to mounting was somewhat helpful. No wheel polishing with abrasive is necessary after polishing down on 000 or 0000 emery paper as no scratches are visible after 0000 paper and further wheel polishing produces increased differences in elevation between the free zinc, the zinc-iron alloys, and the basis iron. Figure (4) was polished through 0000 emery paper and the zinc deposit is entirely free from scratches.

The only method found to be reliable for determining the weight of zinc in sherardized coatings is to strip the coating off in hydrochloric acid and determine the zinc analytically.

Hot-Galvanized Coatings

Hot-galvanized coatings usually contain three distinct zones or phases which are the $FeZn_3$ zone adjacent to the iron, then the $FeZn_7$ zone and finally the free zinc zone which may contain a fraction of one percent of iron in solid solution and the blocklets of the $FeZn_7$ phase distributed throughout it. The assigning of the definite formulas $FeZn_3$ and $FeZn_7$ to the two iron alloys that are visible under the microscope may be open to question, but the important considerations are that the first zone is higher in iron than the second zone, is much more brittle, and has an entirely different microscopic structure (see Fig. (3)).

The $FeZn_3$ zone contains between 20% and 24% iron and the balance zinc. When the immersion time of the iron in the molten zinc is less than one minute, this zone is difficult to detect upon microscopic examination, but for longer times of immersion, this zone may be readily observed. The temperature of the molten zinc, the type of iron used, and the time of immersion determine the thickness of the $FeZn_3$ zone. Figure (3) shows the large brittle $FeZn_3$ zone developed after a piece of iron conduit was immersed in molten zinc at 840° F. for 12 minutes. The entire zinc coating consists of alloyed zinc being .004" thick. The $FeZn_3$ zone is full of shatter cracks and is .0015" thick while the long crystallites of the $FeZn_7$ zone are clearly visible. The $FeZn_3$ zone should be kept as small as possible if a coating with maximum flexibility is desired.

The $FeZn_7$ zone contains between 10 and 12 per

Fig. 3. Heavy Hot-Galvanized Coating .004" Thick. Zone "A" is $FeZn_3$ and "B" is $FeZn_7$. No Free Zinc Present. Immersion 12 Minutes at 840°F. and Blown With 100 Pounds of Air. Mag. 1000X

cent iron and undergoes unusual volume changes during its solidification. The mass as a whole undergoes an expansion rather than a contraction and this zone consists of a porous mass of individual crystallites having virtually no cohesion and the expansion is due

to this porous condition rather than to the formation of a crystal lattice of low density[6]. Both figures (3) and (4) show these crystallites.

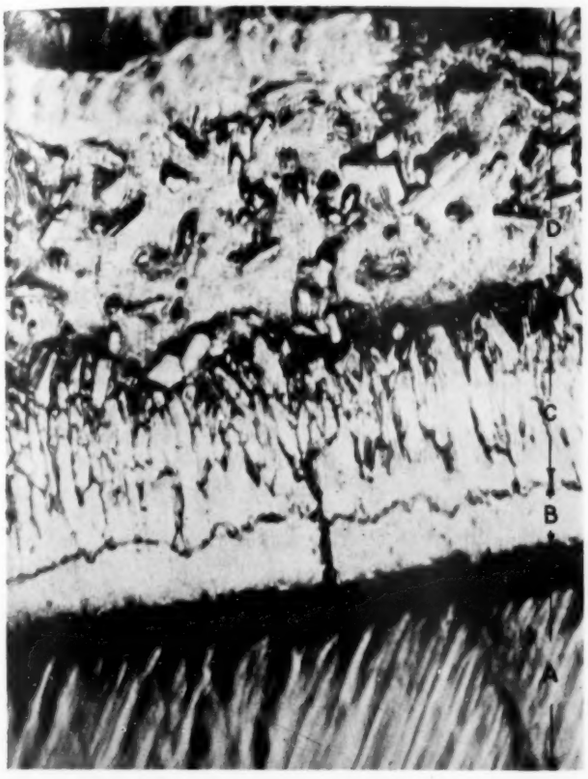


Fig. 4. Hot-Galvanized Coating Showing Three Phases. Mag. 1000X. "A" is Basis Iron, "B" is $FeZn_3$, "C" is $FeZn_7$ and "D" is a Duplex Structure of Free Zinc and $FeZn_7$. The White Band Above Layer "D" is Electroplated Chromium. The Iron was Immersed for 4 Minutes in Molten Zinc at 840°F. and Then Blown With 10 Pounds of Air

The last zone consists of almost pure zinc with blocklets of iron-zinc compound dispersed throughout it. Figure (4) shows the duplex structure of free zinc and iron compound but figure (3) does not because the specimen was blown with 100 pounds of air upon removal of the specimen from the molten zinc. The specimen shown in Figure (4) was blown with only ten pounds of air upon removal from the molten zinc. Hot-galvanized coatings obtained by allowing the specimen to cool in still air may contain much larger quantities of free zinc.

Each zone which has been just mentioned has a different reaction velocity with the solutions used in the Preece test or other testing solutions, being most rapid with the free zinc zone and least rapid with the $FeZn_3$ zone, (See Fig. I). The Glazunov anodic dissolution method or microscopic examination may be used to determine the relative thicknesses of these layers. The error in microscopic measurements for calculating the weight of total zinc may be as much as 30% if the amount of iron in the alloy zones is not taken into consideration. The error is obviously greater when the $FeZn_3$ zone and the $FeZn_7$ zone are greater than the free zinc zone.

In view of the influence of the alloyed iron upon the reaction velocity of the zinc, it is obvious that the most reliable method of determining the quantity of zinc in hot-galvanized coatings is by stripping the total zinc in acid and determining the zinc analytically. The Preece test may be used as a rough field test for different types of coatings and is of value in determining the distribution of the zinc coating. The antimony chloride-hydrochloric acid test gives high results for hot-galvanized coatings and the drop tests are of little value for this type of zinc coating.

[6] See Reference 1, page 173.

Summary

1. The Hull-Strausser drop test, antimony chloride-hydrochloric acid strip measurement, microscopic measurement, and analytical measurements give reliable and correlated results when used on electrodeposited zinc coatings. The Preece test has too large a percentage error for measurement of deposits less than .001" thick.

2. The stripping-analytical method is most reliable for determining the weight of zinc in sherardized coatings. The Preece test gives very unreliable results for sherardized coatings.

3. The most reliable method for determining the amount of zinc in hot-galvanized coatings is the stripping-analytical method. The accuracy of the Preece test, microscopic measurement, and the antimony chloride-hydrochloric acid strip test varies with the ratio of alloyed zinc to free zinc. The Preece test and microscopic measurement are valuable in determining the distribution of the zinc coating.

New Alloy for Wire in Electrical Resistance Standards

An alloy of copper, manganese, and aluminum has been found by the National Bureau of Standards to be superior in several respects to manganin as a resistance alloy for the wire-wound standards which maintain the unit of electrical resistance in the national standardizing laboratories. Manganin, an alloy of copper, manganese, and nickel, is generally used. For use in the construction of precision standards, alloys must be very stable in resistance. In addition to stability, they should have low temperature coefficients of resistance and small thermoelectric powers against copper.

The best proportions of the three metals in the new, superior alloy were found to be approximately: Copper, 85 per cent; manganese, 9.5 per cent; and aluminum, 5.5 per cent. When properly baked, coils of wire made of this material have smaller temperature coefficients of resistance, and smaller thermoelectric powers against copper, than manganin. This alloy appears to be as stable in resistance as is manganin, but it undergoes a large change in resistance with baking, and the baking time and temperature must be carefully controlled.

The use of copper-manganese-aluminum resistance alloys is not new, as Therlo is an alloy of this type. However, the best composition has not been determined before, nor have detailed data been available. A complete description of the method of preparation and data obtained for these alloys is published in the February issue of the **Journal of Research** (RP863) of The National Bureau of Standards, Washington, D. C.

Plating Rhenium and Rhenium-Nickel Alloys

By Dr. C. B. F. YOUNG

Technical Director of the U. S. Research Corporation, Long Island City, N. Y.; Instructor, Chemical Engineering, Columbia University, N. Y. City.

The History, Properties and Methods of Deposition; Rhenium-Rhodium Plate; Nickel-Rhenium Alloy. Interesting Data on this Very Rare Material.

RHENIUM was discovered by Ida and Walter Noddack* in 1925. It received its name from the river Rhine. As one would expect, comparatively little is known of this element, for it was discovered only ten years ago. The metal is obtained from molybdenite ores where it is associated with molybdenum sulphide (MoS_2) to the extent of 2 to 20 parts per million, in the best grades. Another source of supply is from the Ural Mountains where it is associated with the platinum ores. At present most of the world's supply comes from the copper refining slimes where it is found to occur to the extent of one part per million. The element is distributed widely throughout the earth's crust, but in no place does it occur in more than a trace.

Many attempts to electroplate rhenium had been made, but only black deposits resembling platinum black were obtained.*** Bright plates of Rhenium were first obtained by Fink and Deren**. According to those authors the reason for failure in the past to obtain bright, hard deposits was the lack of control of the hydrogen ion values, current density, temperature, concentration of the salts, etc.

Fink and Deren used various baths to deposit rhenium, including sulfate, phosphate, alkaline and oxalate solutions. Out of these baths, the sulfate was chosen as it is adapted to standard commercial plating equipment. Two of the sulfate baths are listed below:

Bath I

Potassium Perrhenate ($KReO_4$)	11.0 g./l.
Conc. sulfuric acid (H_2SO_4)	1.84 sp. gr. 3.3 g./l.
pH	0.9
Temperature	25°-45° C. (77°-113° F.)
Current density	90-110 amps./sq. ft.

Bath II

Perrhenic Acid ($HReO_4$)	20 g./l.
Conc. sulfuric acid (H_2SO_4)	1.84 sp. gr. 5 g./l.
pH	0.7 to 1.2
Temperature	25°-30° C. (77°-86° R.)
Current density	90-140 amp./sq. ft.

Properties of Rhenium

Rhenium, with an atomic weight of 186.3, is a very heavy metal. The atomic number is 75, which places it between tungsten (74) and osmium (76). Goldschmidt**** determined its specific gravity as 21.4. Rhenium is both ductile and malleable. It is quite soluble in nitric acid, but practically insoluble in hydrochloric acid, according to Fink and Deren**, who found that rhenium samples immersed in concentrated or dilute hydrochloric acid solution were unchanged both in weight and lustre after three days' immersion. They also found the hardness of rhenium plate to be 250 Brinell as against 150 Brinell for Rhodium, and 400 Brinell for chromium. This agrees with that found by previous authors.

Deposition of Rhenium

A rhenium deposit upon brass was desired. After due consideration, Bath I was decided upon, chiefly because potassium perrhenate could be obtained. A solution containing 11 g./l. potassium perrhenate, 3.3 g./l. concentrated sulfuric acid was used at 20° C. with a current density of 100 amps./sq. ft. This solution was used according to the above conditions, having platinum as an insoluble anode but black deposits of rhenium were produced. In order to correct this trouble, the current density was varied from 50-150 amps./sq. ft., while the temperature was increased from 20° C. to 50° C. Regardless of these changes, **only** black deposits of rhenium were obtained.

It was decided to decrease the pH of the solution by adding more sulphuric acid, while keeping the other variables constant. As more and more sulfuric acid was added, the plates of rhenium became progressively brighter. Upon the addition of 9.3 g./l. concentrated sulfuric acid, a solution was obtained, which, if electrolyzed according to the conditions above, would give a bright, smooth, hard deposit of rhenium. Thus Bath I should be changed to:

Bath IA

Potassium Perrhenate ($KReO_4$)	11.0 g./l.
Sulfuric acid (H_2SO_4)	1.84 sp. gr. 9.3 g./l.
Temperature	25° to 45° C. (77°-113° F.)
Current density	90-110 amps./sq. ft.

Rhenium-Rhodium Plate

Although rhenium gives a hard bright deposit, if compared to a rhodium plate, it will be found to be much darker. Therefore, for jewlery, etc., a rhodium finish is more desirable. On the other hand rhenium is practically insoluble in hydrochloric acid, one of the principal acids in perspiration, while rhodium is not. For articles of jewelry, worn next to the skin, it is very desirable to have a deposit which is insoluble in hydrochloric acid and which is pleasing

* Sitzungsber, Preuss, Akad. Wissenschaft. 19, 400 (1925).
** Fink and Deren. Transactions of Electrochemical Society, Vol. 66, pages 471-474 (1934).
*** C. Agte, H. Alterthum, K. Becker, G. Heyne and K. Noers, Die physikalischen und chemischen Eigg. des Rheniums.
Naturw., **18** 108 (1930); Z. Anorg. Allem. Chem., **196**, 129 (1931).
Z. Anorg. Allem. Chem., 202, 277-291 (1931) ibid, **211** 195-206 (1933).
**** Naturwissensch, **17** 134 (1929).

to the human eye. For these conditions it was decided to deposit first a layer of rhenium and second a layer of rhodium. In this way, both protection and attraction are assured.

With the above facts in mind, brass plates, 1" x 3" were plated with a heavy coat of rhenium and then replated with rhodium. Much to the disgust of the writer, the rhodium made the rhenium curl away from the brass cathode. At times the curling would take place during electrolysis; at other times it would occur after the plate had been removed from the solution.

When nickel peels, it is often caused by hydrogen, which is liberated at the cathode along with the nickel. The same reason might be the cause of the peeling of rhenium. In order to overcome this condition, hydrogen must be prevented from being included in the rhenium deposit, or, if it is included, it must be removed before the rhodium is applied. A very good way to remove hydrogen is by heat. The rhenium deposits were heated at different temperatures from 110° to 300° C. If heated to 110° C. for a 12-hour period, small areas darkened. This was undoubtedly due to the formation of an oxide. If heated in the oxidizing flame of a Bunsen burner (care being taken not to heat above 250° C.) the rhenium deposit turned a deep wine red. If left in the flame too long, the whole plate darkened. This also must have been due to the formation of complex rhenium oxides. No manner of heating aided materially in keeping the deposit from curling.

The next method used was to flash the brass article with another metal before applying the rhenium. The brass was first plated with a flash of rhodium, and then with rhenium. The results were good. The theory behind the results obtained seems to be that the hydrogen over-voltage is greater on rhodium than on brass. In this way the hydrogen was not liberated with rhenium, and the result was—no curling.

Nickel-Rhenium Alloy

In their paper on "Rhenium Plating," Fink and Deren** state that rhenium can be co-deposited with other metals such as cobalt and nickel. An attempt was made to co-deposit nickel and rhenium. Solution IA was used as a foundation bath, and varying amounts of nickel sulfate ($NiSo_4.6H_2O$) were added. After each addition a deposit was made using an insoluble platinum anode and brass cathode. The

Bath III

Potassium Perrhenate ($K ReO_4$)	11.0 g./l.
Nickel sulfate ($NiSO_4.6H_2O$)	6.0 g./l.
Sulfuric acid (H_2SO_4)	1.84 sp. gr. 9.3 g./l.
Temperature	25°-50° C.
Current density	50-60 amps./sq. ft.

deposit, obtained, from this solution was stripped electrolytically in a dilute sulfuric acid bath. This solution was then tested for nickel by the di-methyl glyoxime method.

At this point a rather interesting observation was made. If di-methyl glyoxime is added to a solution containing rhenuim, a red colored **solution** (no precipitate) results. If a red precipitate results, nickel is present; if there is only a red color of the solution, rhenium alone is present.

The alloy of nickel-rhenium is somewhat lighter in color than pure rhenium. There was a slight tendency for the plate to "tree." For this reason the current density was lowered from 100 amps./sq. ft. to 50 amps./sq. ft. No quantitative tests were carried out to determine the exact ration of nickel and rhenium.

Acknowledgments

The author is indebted to Prof. Colin G. Fink who furnished the rhenium salts and suggested the work.

Specifications for Metals

File These With the Brass Founders' Manual

Specifications for Lead

OF THE AMERICAN SOCIETY FOR TESTING MATERIALS

Corroding Lead (Grade I):

Silver	not over 0.0015%
Copper	not over 0.0015%
Copper and Silver together	not over 0.0025%
Arsenic	not over 0.0015%
Antimony and Tin together	not over 0.0095%
Zinc	not over 0.0015%
Iron	not over 0.0020%
Bismuth	not over 0.0500%
Lead (by difference)	99.9330%

Note: The maximum limits for Bismuth, Copper and Silver have been given but it is not expected that any delivery will contain the maximum of all three.

Chemical Lead Grade (II)[1]:

Silver	0.005-0.015%
Copper	0.040-0.080%
Bismuth	less than 0.005%
Lead	Balance

[1] Chemical Lead is a trade name used to designate the undesilverized lead produced from Southeastern Missouri ores.

Common Lead (Grade III):

(a) Desilverized Lead:

Silver	not over 0.0020%
Copper	not over 0.0025%
Arsenic, Antimony and Tin together	not over 0.0150%
Bismuth	not over 0.2500%
Iron	not over 0.0020%
Zinc	not over 0.0020%
Lead (by difference)	99.7265%

(b) Soft Missouri Lead[2]:

Silver	not over 0.002%
Copper	not over 0.040%
Arsenic, Antimony and Tin together	not over 0.015%
Bismuth	not over 0.005%
Iron	not over 0.005%
Zinc	not over 0.002%
Lead (by difference)	99.931%

[2] Soft Missouri Lead is a trade name used to cover soft undesilverized Lead.

Specifications for Zinc

OF THE AMERICAN SOCIETY FOR TESTING MATERIALS

	Maximum, Per Cent				Sum of Lead Iron & Cadmium
	Lead	Iron	Cadmium	Aluminum	
(1a) Special High Grade	0.010	0.005	0.005	none	0.010
(1) High Grade	0.070	0.030	0.070	none	0.100
(2) Intermediate	0.200	0.030	0.500	none	0.500
(3) Brass Special	0.600	0.030	0.500	none	1.000
(4) Selected	0.800	0.040	0.750	none	1.250
(5) Prime Western	1.600	0.080	.....	.....	.....

Electrochemical Society Meeting

In Cincinnati, Ohio, April 23-25. Abstracts of Papers on Inhibitors; Copper, Nickel, Cobalt Manganese, Thallium and Zinc Plating; Beryllium Copper.

At the Annual Meeting of the Electrochemical Society held in Cincinnati, Ohio, on April 22nd, 1936, **Dr. Duncan A. MacInnes** of the Rockefeller Institute for Medical Research, New York City, was elected President of the Society. The three new vice presidents are **H. Jermain Creighton, S. D. Kirkpatrick** and **R. R. Ridgway.** The three new managers are **M. A. Hunter, F. A. Lidbury** and **E. C. Sprague. Dr. Robert M. Burns** was reelected Treasurer, and **Colin G. Fink,** Secretary in the Society.

Honorary membership in the Society was awarded to **Dr. L. H. Baekeland,** of the Bakelite Company, New York, a past president of the Society.

The Electrochemical Society awarded the eighth Weston Fellowship of $1,000.00 to **Dr. Henry B. Linford** of Pullman, Wash. Dr. Linford will continue his studies on the electrochemical properties of the elements of the fourth group in the periodic table, the work to be done under the direction of **Prof. Colin G. Fink** at Columbia University, New York City.

INHIBITORS—SAFE AND DANGEROUS

By Ulick R. Evans

An attempt to inhibit the **anodic** reaction of a corrosion-change controlled by the **cathodic** reaction will usually diminish the corroded **area** more quickly than it diminishes the total **destruction** of metal, and thus increase the **intensity** of corrosion if the addition has been insufficient to stop attack altogether; such methods of inhibition are dangerous. This intensification of attack will not occur where the corrosion is under **anodic** control, or where the inhibitor is one which smothers the **cathodic** reaction. The principles are applied in discussing the addition of alkali to hard, soft and saline waters, and also the treatment of brine with chromate. The classification of protective processes into safe and dangerous groups can be extended to protection by oxide-films, paints and metallic coats.

THE USE OF INHIBITORS (WITH SPECIAL REFERENCE TO ANTIMONY) IN THE SELECTIVE REMOVAL OF METALLIC COATINGS AND RUST

By S. G. Clarke

Inhibitors of the type represented by quinoline restrain the action of hydrochloric acid on a wide variety of metals, while antimony chloride is selective in its action, powerfully restraining the action of the strong acid on iron, nickel and cobalt, but markedly accelerating the dissolution of zinc, cadmium, tin and chromium. This behavior may be made the basis of methods of removing quantitatively metals of the last mentioned group when present as coatings on metals of the first group. Copper and brass show slightly greater attack in hydrochloric acid-antimony chloride solution than in hydrochloric acid alone, but as the attack is slow copper and brass may be included with metals of the first group for this practical application. Published processes in which antimony has been utilized as inhibitor have so far been described for zinc, cadmium and tin as coating metals on iron and steel. The restraining action of antimony in hydrochloric acid solution extends to low and high carbon steel, chromium steels, wrought iron and gray cast iron; the efficiency was rather low with wrought iron, and distinctly less with cast iron. The rate of attack on electrodeposited zinc and cadmium varied with the conditions under which the metals were deposited.

THE GENERAL TRANSFORMER, A NEW SOURCE OF DIRECT CURRENT POWER FOR ELECTROCHEMICAL PURPOSES

By George T. Southgate

The apparatus described is essentially a stationary general transformer of alternating and direct currents. In typical utilization, alternating current power is received into a subdivided shell-type transformer, changed in desired ratio as to voltage and current and, through an included system of reed-mounted, vibratory contacts, commutated to direct current for delivery. There is no mechanical rotation, and no movement whatever except processional vibration of numerous commutative elements tuned to 60, 50 or 25 cycles. Large currents are feasible, and the losses and efficiencies are substantially those of ordinary transformers. In contrast with existing means, the new apparatus may be economically built for the lower direct current voltages.

ALKALINE PLATING BATHS CONTAINING ETHANOLAMINES

Part 1.—Copper Plating From Triethanolamine Solutions.

By C. J. Brockman and A. L. Brewer

The production of strike plates from solutions of copper salts containing triethanolamine is compared with those from other solutions. A new solution has been developed which will not plate copper by replacement when brought in contact with iron. This

solution will in 70 seconds produce a bright adherent copper plate at 0.4 amp./dm.^{2} (3.6 amp./sq. ft.) capable of taking a subsequent good, adherent copper plate from the commercial acid copper sulfate bath. The solution contains 15 g./L. $CuSO_4$, 5 H_2O, 10 g./L. sodium oxalate and 22 cc./L. triethanolamine.

Part 2.—A Study of Baths Containing Triethanolamine for the Direct Nickel Plating of Zinc.

By C. J. Brockman and J. P. Nowlen

This paper presents the results of a study of plating baths for the direct nickel plating of zinc. The following solutions examined contained either just enough triethanolamine to give a clear solution or they contained an excess of triethanolamine: (1) nickel ammonium sulfate solution; (2) nickel ammonium sulfate-nickel sulfate solution; (3) nickel ammonium sulfate-boric acid solution; (4) nickel sulfate solution; (5) nickel chloride solution; (6) nickel ammonium sulfate-nickel chloride solution. The plating conditions of the six solutions were determined at different temperatures, concentrations, and current densities. Current density vs. potential measurements were made during the plating processes.

Part 3.—Cobalt Plating from Triethanolamine Solutions.

From solutions of cobalt sulfate containing triethanolamine it is possible to plate cobalt successfully on copper, steel, nickel and zinc at current densities ranging from 0.5 to 25 amp./dm.^{2} (4.7 to 234 amp./sq. ft.), at room temperature or slightly above. Cathode efficiencies were as high as 98 per cent. The plates are slightly darker than the corresponding nickel plates.

Part 4—The Deposition of Nickel-Cobalt Alloys From Solutions Containing Triethanolamine

From solutions containing triethanolamine, nickel chloride, nickel sulfate, cobalt sulfate and some sodium sulfate it has been found possible to deposit alloys of nickel and cobalt. The concentrations of the nickel and cobalt ions may vary within considerable ranges. The current density may vary between 3.4 and 15.5 amp./dm. (32 and 144 amp./sq. ft.).

THE ELECTRODEPOSITION OF MANGANESE FROM AQUEOUS SOLUTIONS

I. Chloride Electrolytes.

By Harold H. Oaks and W. E. Bradt

The results of a systematic study of the conditions affecting the electrodeposition of manganese from aqueous chloride solutions are presented. Variables investigated include: cathodic current density, temperature, addition agent, cathode material, anode material, diaphragm, concentration of manganese, and agitation. Data also are presented on the variation of the manganese content of the bath during electrolysis, on current efficiency and on the nature and purity of the electrodeposited manganese. Smooth, silver-white plates of pure manganese were obtained that could be given a very high polish, and had a hardness of 5.5 to 6.0 on the Mohs' scale. The preferred bath contained 350 g./L. $MnCl_2$ and 30 g./L. NH_4Cl; 26° C.; 20 amp./dm.^{2}

THE SIMULTANEOUS ELECTRODEPOSITION OF THALLIUM AND ZINC

By W. George Parks and I. Milton LeBaron

The relative concentrations of thallium (as perchlorate) and zinc (as nitrate) in the baths and of the two metals in the resulting plates at different current densities were determined and plotted. Electroplates of different composition were polished and microscopically compared with cast alloy specimens. Similar structure was observed for the eutectics only. No serviceable or useful plates were obtained.

BERYLLIUM COPPER USED IN ELECTRICAL SWITCH SPRING

By A. L. Riche

Springs made of 2¼ per cent beryllium copper alloy heat treated at 260° C. have withstood many million flexures. These springs are mechanically superior to those made of phosphor bronze. They are furthermore resistant to corrosion and a good conductor of electricity.

ALUMINUM PLATING FROM ORGANIC BATHS

By R. D. Blue and F. C. Mathers

Aluminum can be electrodeposited, with a cathode efficiency of above 75 per cent, from a bath containing the condensation or reaction products formed when aluminum bromide and aluminum choride are dissolved in ethyl bromide and benzene. Also, hydrobromic acid and hydrochloric acid give condensation products in benzene with aluminum bromide and aluminum chloride, from which aluminum can be electrodeposited. The baths described in this paper are easier to prepare and are less expensive than those described in the earlier papers.

ELECTRODEPOSITION OF ALUMINUM ALLOYS

By R. D. Blue and F. C. Mathers

Most of the heavy metals could be electrodeposited with aluminum as alloys from the aluminum bath containing aluminum bromide, aluminum chloride, ethyl bromide, benzene, and xylene. The limiting concentration of aluminum for bright deposits varied with the different alloying metals.

NICKEL-COBALT ALLOY PLATING FROM ACID SULPHATE SOLUTION

By C. B. F. Young and N. A. Gould

The co-deposition of nickel and cobalt from an acid sulfate solution using a rotating cathode was investigated. The effects of temperature, agitation, current density, hydrogen ion concentration, and addition agents were determined. Increasing the temperature of the bath resulted in an increase in the cobalt of the alloy produced. Increasing the speed of rotation of the cathode decreased the nickel content of the resultant plate obtained. A decrease of current density had the effect of decreasing the cobalt content of the alloy deposited. A change in hydrogen ion concentration toward lower acidity resulted in an increase in the nickel of the alloy plate. Gelatin added to the solution produced bright deposits at a fairly high current density without noticeable effect on the composition of the alloy.

Newark Platers Hold Open Meeting

Abstracts of Papers Presented at the Sixteenth Annual Open Meeting and Banquet of the Newark Branch, American Electro-Platers Society, April 18th.

By G. BYRON HOGABOOM
Associate Editor

Dr. C. B. F. Young of the **U. S. Research Corp.**, 40-35 21st St., Long Island City, N. Y. and member of the faculty of electrochemistry at Columbia University gave an outline of the courses given by him on the subject of electroplating. Students are first required to take a course in general chemistry in which a systematic study is made of all the common elements and some of the less common ones. In this work many problems are given out for calculation.

The course in electroplating is conducted to a considerable extent by means of laboratory experiments. The students make up their own plating solutions and make tests on them. The effect of temperature, concentration of constituents in the solution, addition agents, and other factors are studied. Measurements are made of cathode efficiencies, conductivity, and throwing power. There are also experiments in alloy plating, corrosion testing, analysis by means of the microscope and analysis of solutions. An experiment on the anodizing and coloring of aluminum is particularly popular, Dr. Young stated.

Dr. F. V. Level of **Chas. Hardy, Inc.**, 415 Lexington Avenue, N. Y., spoke on **"Powder Metallurgy."** This talk dealt with the preparation and use of metallic powders in the manufacture of such articles as oil-less bearings, electric machine brushes, and metal objects of such shape that casting or machining methods would not be applicable.

The art of powder metallurgy is about 30 years old. Tungsten and molybdenum were the first metals to be worked as powders, due to the fact that their melting points are so high that it is difficult to hold them in a molten condition. At the present time tungsten wire for incandescent bulbs is made by starting with tungsten oxide which is reduced to metallic powder by means of hydrogen. The powder is then compressed into small bars. The bar is sintered by passing a heavy electric current through it. Then it is passed through a swaging machine and finally through dies of gradually decreasing size until the desired wire is obtained.

Metal powders may be prepared by electrolysis. The general scheme is similar to the usual electrodeposition of metals except that conditions are maintained so that the deposit will be powdery. For this purpose the metal concentration of the solution is kept low, a high current density is used and an addition agent dissolved in the solution. Electrolytic metal powders are better than powders produced by crushing of the solid, as can be done with some metals, because the former type powder has an angular shape which is the most desirable.

The manufacture of oil-less bearings is the largest application of powder metallurgy today. A mixture of copper, tin, and graphite is compressed into the bearing shape. The result is a porous mixture that will soak up considerable oil and retain it for some time thus eliminating the necessity for frequent oiling. Several bearings of this type are found in the modern automobile and also in washing machines and clocks.

Austin Fletcher of the **Brewer Tichenor Co.**, Binghamton, N. Y., gave a talk on **"My Experience with Barrel Plating."** Many experiments were conducted with a barrel in the cadmium plating of small parts. Quite a few figures were given on efficiency. It was stated that a barrel speed of 4½ rpm were used. The formula of the solution employed was cadmium 1½ ounces and free cyanide 9 ounces per gallon of water.

Oliver J. Sizelove, of the **Frederick Gumm Chemical Co.** gave an account of some of the bright nickel processes now on the market. The **Pyrene Mfg. Co.**'s solution is based on the **Schlotter** patent. The deposit is said to be free from carbon and organic compounds. The brightening agent is self-regenerative. Pitting, it is said, has been eliminated. The **Weisberg & Greenwald** solution claims a deposit of high ductility, good throwing power, and a blue-white color. Analytical control of all the solution constituents, including the brightening agent, has been worked out. In the **Harshaw** process it is claimed that no trouble is had with pitting. The pH must not be allowed to go too high or the brightening agent will precipitate out. Ductile deposits are also obtained.

Mr. Sizelove discussed cadmium and cobalt as brightening agents in a nickel solution. The addition of cadmium to a nickel solution will give a bright nickel but the deposit will be hard and brittle. The yellow tint of the deposit can be overcome by adding some cobalt to the solution. Both of these metals are best added in the form of their salts, either the chloride or sulphate. The use of cadmium was advocated for barrel nickel work. For still tanks gum arabic may be employed. A stock solution is made by dissolving 4 ozs. of the gum to 1 gal. of cold water. Eight ounces of this stock solution is used per 100 gallons of plating solution.

George B. Hogaboom of the **Hanson-Van Winkle-Munning Company**, Matawan, N. J., gave an interesting talk on **"Protective Coatings for Metals."** The speaker illustrated his talk with a series of slides

which clearly depicted the points under explanation. One slide showed the structure of the coating applied by the Schoop process which consists of spraying molten metal on the objects to be processed. The type of coating obtained in the sherardizing process, in which the articles are tumbled with zinc oxide in a retort under heat, was also shown. Hot galvanizing was discussed in detail with illustrations of the effect of iron in the coating.

Photomicrographs of the structure of hot galvanized coatings were shown which brought out the different alloy layers of $FeZn_3$ and $FeZn_7$. It was shown that hot galvanized wire, even if annealed, cracked when bent on its own diameter. This is probably due to the brittle $FeZn_3$ alloy next to the basis metal.

Electrodeposited zinc coatings were then illustrated. A cross section of Bethanized wire, on which the zinc was deposited at 1,000 amps. per sq. ft. were shown. This had a fine dense structure.

The effect of metal concentration, agitation, and current density used in both acid and alkaline zinc electroplating solutions were shown and it was brought out that to obtain deposits of zinc that would give best protective life against corrosion the plater must pay attention not only to the cleaning but also to the composition of the plating solution and methods of operation if a good bond is desired between deposit and basis metal.

The results of the exposure tests on plates processed at the **National Bureau of Standards** under the direction of the **American Electro-Platers' Society** and exposed at several stations of the **American Society for Testing Materials**, were illustrated by curves. It was brought out that equal thickness of cadmium and zinc had approximately the same protective value in some cases, particularly in a marine atmosphere. Cadmium was not as good as zinc, however, in industrial atmospheres.

The results of the accelerated tests, the salt spray and intermittent immersion, were shown and it was clear from the data obtained that the salt spray test is applicable only to ascertaining the quality of deposits at the place where they are produced. The question was raised as to whether a value could be given for outdoor exposure based on results obtained in a salt spray, in view of the marked difference in rate of corrosion of zinc at the several A.S.T.M. stations in the study of the outdoor exposure tests. It was stated that due to improper preparation of the basis metal and the lack of control and the proper methods used, zinc coatings in former years did not prove satisfactory. With our present knowledge of control work there is every reason to believe that zinc electroplating will be firmly established.

It was also stated that due to the shortage of cadmium considerable research work has been done with electro-zinc deposits which has resulted in the development of solutions from which bright zinc deposits can be had that compare very favorably with cadmium coatings. While cadmium will always have its place wherever special finish is required, it is predicted that zinc coatings will prove so satisfactory that they will be as acceptable and probably give better protection than was had with cadmium coatings.

Army and Navy Identification Discs

Q.—I wish to make a large number of identification discs the same as furnished soldiers in the late war. Kindly let me know the kind of metal to use and where I can obtain it; also the methods of manufacture.

A.—You did not send a sample, and we are not sure that all the discs were made of the same metal and shape. However, the discs that we have on hand are made of aluminum for the army, and of stainless steel or nickel steel for the navy. The thickness of the steel is 20 gauge, or .035 inch, and the size of the disc is 1⅛ inch by 1½ inch, with semi-circular ends. A hole about 3/16 inch is punched near one end. The stampings are cut from the strip steel and the hole punched in one operation. A plain punch and die would be used, and a moderately sized press would do the work.

The lettering is printed with a pen on the discs by hand, using an ink that adheres as a protective coating to prevent the etching of the metal under the ink. After the data has been marked on the side of the disc, the thumb print is made on the reverse side, and then the disc is placed on an etching bath. An electric current could be used to hurry the operation and to make the etching deeper, so that all the characters appear raised on the disc. The ink can be obtained from any advertiser of etching materials, and the chemicals for the solution could be obtained from the same source.

The identification discs for the army are of aluminum and 1⅛ inch in diameter and 1/16 inch thick, and have two 3/32 inch holes. The holes are to be threaded with a white woven cord long enough to be tied around the neck. The discs are cut from aluminum strip by a plain die and punch set. All the letters are capitals and were struck by hand by the use of individual steel letter dies. The face of the disc contains the name of the individual stamped around the edge, including USA. Across the disc is his rank, as O R D, and 2 L. T. No dates or finger prints were used, the reverse side being plain. The aluminum discs are inferior to the stainless steel ones in appearance, sanitary condition and durability.

The strip metal could be bought from any dealer in general sheet metals, such as the Jos. T. Ryerson & Co., Lock Box U, Chicago, Ill. This firm can also help you in selecting the right kind of metal and the press and dies.—**W. B. Francis.**

Removing Borax

Q.—Is there anything that will remove borax from metal after soldering, besides sulphuric acid? If not what mixture do you recommend in pickling copper and brass?

A.—Borax can be removed from metal after soldering by immersion in boiling water.

The use of a 20% sulphuric acid pickle operated at 180 deg. F. will remove heavy oxide formation or fire scale. A pickle for use prior to bright dipping may be made up as follows:

Sulphuric acid	2 parts
Nitric acid	1 part
Water	5 parts
Temperature	cold

—**T. H. Chamberlain.**

American Foundrymen's Association Annual Convention in Detroit

General Plans and Tentative Program for May 4-9.

THE 1936 Annual Convention of the American Foundrymen's Association was held in Convention Hall, Detroit, the week of May 4 to 9, as we went to press. In connection with the convention was held the Foundry and Allied Industries Exposition. Full details will be published in our next issue.

The program showed a well balanced schedule of papers and reports on practical operating and metallurgical problems of all branches of the industry.

W. H. JOSEPH CLUFF

Director, American Foundrymen's Association, Chairman of the Transportation Committee for the Detroit Convention. He is President of the Frederick B. Stevens, Inc., Detroit, Mich. and one of the active figures in the Convention

Of outstanding significance were the session on progress in the medical, legislative and engineering aspects of safety and hygiene in the foundry. Of equal importance were the session on apprentice training. These two subjects are of greatest current interest. The non-ferrous foundry sessions featured papers covering shop practice in the production of special bronzes. General interest papers on refractories and sand research were also presented. One meeting was arranged for the discussion of shop training in engineering schools. Three papers from European foundrymen were included in the schedule of sessions.

A complete schedule of the non-ferrous and related sessions and events of the week is given below.

MONDAY, MAY 4

Registration—Convention Hall.
Plant Visitation.

TUESDAY, MAY 5

9:00 A. M. Registration—Convention Hall.

9:00 A. M. to 6:00 P. M. Exhibits Open—Convention Hall.

10:00 A. M. **Opening Meeting — Fortieth Annual Convention.**
Address of Welcome
Harvey Campbell, Detroit Board of Commerce.
Announcements.
President's Annual Address
D. M. Avey, Penton Publishing Company, Cleveland, Ohio.

11:00 A. M. **Non-ferrous Casting Practice.**
Chairman, **Jerome Strauss,** Vanadium Corp. of America, Bridgeville, Pa.
Manganese Bronzes, Dr. F. R. Hensel, P. R. Mallory Company, Indianapolis, Ind.
Pressure Castings in Aluminum Bronzes, H. T. Ganzuage, Goulds Pumps, Inc., Seneca Falls, N. Y.
Annual Business Session—Non-ferrous Division.
Report of Election of Officers.
Report of Committee on Recommended Procedure for the Analysis of Defects.

2:00 P. M. **Sand Research**
Chairman, **R. F. Harrington,** Hunt-Spiller Mfg. Corp., Boston.
Vice-Chairman, **W. G. Reichert,** Singer Mfg. Company, Elizabeth, N. J.
The Constitution of Bonding Clays and Its Influence on Bond Properties, R. E. Grim, R. H. Bray, and **W. F. Bradley,** Illinois State Geological Survey, Urbana, Ill.
Deformation of Molding Sand, H. W. Dietert and **R. A. Dietert,** H. W. Dietert Company, Detroit, Mich.
Practical Sand Control in Gray Iron Foundries, H. Deane, Deere & Company, Moline, Ill.
Foundry Sand Testing Problems at High Temperatures, P. E. Kyle, Massachusetts Institute of Technology, Boston, Mass.
Committee Reports.

4:00 P. M. Sand Control Shop Course (Session 1).

7:00 P. M. Joint Dinner and Smoker, Foundry Equipment Manufacturers Association, A.F.A., and Detroit Chapter of A.F.A.

WEDNESDAY, MAY 6

9:00 A. M. to 6:00 P. M. Exhibits Open—Convention Hall.

12:30 P. M. Luncheon and Round Table Discussion—Non-ferrous Division

Chairman, **T. C. Watts,** Falcon Bronze Company, Youngstown, Ohio.

Vice-Chairman, **H. J. Rowe,** Aluminum Company of America, Cleveland. **Harold J. Roast,** Canadian Bronze Company, Montreal, P. Q.

H. M. ST. JOHN
Chairman, Non-Ferrous Division, A. F. A.

Topics for Discussion:

1. Melting Practice:
   (a) Furnace Atmosphere.
   (b) Furnace Operation.
2. Insulation of Furnaces.
3. Relation between Deoxidizer Content, Gates, Risers, Pouring Temperature, Shrinkage, and Sand Attack.
4. Questions on Papers read at Convention, on:
   (a) Aluminum Bronze.
   (b) Silicon Bronze.
   (c) Manganese Bronze.
5. Cast Metals Handbook—How can it be made more helpful?

2:00 P. M. **Apprentice Training.**

Chairman, **C. J. Freund,** Dean of Engineering, University of Detroit.

Foundry Apprentice Training, Franklin R. Hoadley, Farrel-Birmingham Company, Ansonia, Conn.

Apprentice Training in Detroit Industries, H. W. Boulton, Murray Corp., Detroit, Mich.

Training Foundry Apprentices in Cleveland, J. R. Goldie, Cleveland Vocational School, Cleveland, Ohio.

3:30 P. M. A.F.A. Cost Committee.

4:00 P. M. Sand Control Shop Course (Session 2).

8:00 P. M. **Foundry Refractories.**

Chairman, **C. E. Bales,** Ironton Fire Brick Company, Ironton, Ohio.

Vice-Chairman, **A. H. Dierker,** Engineering Experiment Station, Ohio State University, Columbus, Ohio.

Notes on Some Foundry Refractories, J. D. Sullivan, Battelle Memorial Institute, Columbus, Ohio.

Open Forum—Insulated Ladles.

THURSDAY, MAY 7

9:00 A. M. to 6:00 P. M. Exhibits Open—Convention Hall.

10:00 A. M. **Non-ferrous Castings.**

Chairman, **H. M. St. John,** Detroit Lubricator Company, Detroit.

Vice-Chairman, **T. E. Kihlgren,** International Nickel Company, Bayonne, N. J.

Sand Castings of the Copper Silicon Alloys, H. A. Bedworth and **V. P. Weaver,** American Brass Company, Waterbury, Conn.

Founding Aluminum Bronzes, J. E. Crown, Naval Gun Factory, Washington, D. C.

Report of Committee on Recommended Practices.

3:30 P. M. Annual Business Meeting.

4:00 P. M. Sand Control Shop Course (Session 3).

7:00 P. M. A.F.A. Annual Dinner.

FRIDAY, MAY 8

9:00 A. M. to 6:00 P. M. Exhibits Open—Convention Hall.

2:00 P. M. **Progress of Medical, Legislative and Engineering Aspects of Safety and Hygiene in the Foundry.**

E. O. JONES
Director, Safety & Hygiene Section, A. F. A.

Chairman, **D. M. Avey,** President, A.F.A.

Medical Aspects:

Dr. R. R. Jones, Past Assistant Surgeon, Division of Labor Standards, U. S. Dept. of Labor, Washington, D. C.

Legislative Aspects:
Voyta Wrabetz, Chairman, Industrial Commission of Wisconsin.

Open Forum:
Forum Leader: **Dr. J. A. Britten**, Chief Surgeon, International Harvester Company, Chicago.

SATURDAY MAY 9

9:00 A. M. Exhibits Open—DETROIT DAY.
4:00 P. M. Exhibits Close.

Joint Stag Dinner

The American Foundrymen's Association, the Foundry Equipment Manufacturers' Association, and the Detroit Chapter of the A.F.A., arranged for a complete stag dinner, followed by entertainment in charge of a very interesting master of ceremonies, held at the Statler Hotel in Detroit, Michigan, at 7:00 P. M., Tuesday evening, May 5.

All those attending the dinner were permitted to participate in drawings for valuable prizes. The committee gave a variety of attractive awards. The cost of the tickets, including participation in the grand drawing, was $2.00 each.

1936 Awards to David McLain and Dr. H. Ries

The Board of Directors of the American Foundrymen's Association announces that acting on the recommendation of its Board of Awards, it is granting the **Joseph S. Seaman Medal** of the Association to **Dr. Heinrich Ries** in recognition of his outstanding services to the foundry industry and to the Association in the field of foundry sand research and control, and to **David McLain** it has awarded the **J. H. Whiting Medal** in recognition of his contributions to the foundry industry in stimulating better melting.

Old Gold Solutions

Q.—I'm a subscriber to **Metal Industry** and Platers' Guide, and I have seen where you helped a great many people out of their difficulties; will you be so kind as to help me with my trouble. I have quite a few old gold solutions which I would like to refine. Please tell me the best way to handle them.

A.—Different kinds of solutions require different handling, and we are not so sure which kind you have. Possibly you have old gilding solutions, which contain some gold, some base metal and dirt, some cyanide, etc. Possibly you have old stripping solutions, which would contain rather more base metal and less gold. Possibly you have old aqua regia solutions, obtained from incomplete refining operations; these also contain base metals, as well as acids and small amounts of gold, and possibly some platinum and palladium as well.

First, if you have any solutions that are strongly acid, such as strong aqua regia solutions, evaporate them down to a syrup to drive off as much nitric acid as possible. Use an evaporating dish, and boil down slowly, so as to avoid spattering, until most of the acid and excess water has evaporated away. Usually more or less material appears as a crust around the edge of the dish; this may simply be impurities, but usually it contains gold as well. Add a little plain water, to dissolve this crust. Possibly some will not dissolve; in that case keep it; it may be of value.

Next, place your solution, whether it be an acid solution, or an old gilding solution, or whatever it may be, in a good-sized jar or crock (not a bottle) and add zinc. Zinc will precipitate or throw down all the precious metals, including gold, silver, platinum, and palladium. Zinc shavings are best; zinc plate cut into narrow strips is much slower. Zinc powder is not so good. Zinc granules, about as fine as coarse sand, are also good, and "granulated" zinc or zinc pellets can be used.

In solutions that contain even a little acid, the zinc goes to work at once, and may become quite hot. Cyanide solutions are much slower—it may be necessary to leave them standing for several days. Stir from time to time with a stick or wooden spoon, so as to bring all parts of the liquid in contact with the zinc. The zinc will slowly dissolve, and in its place the heavy metals—gold, silver, platinum, copper, lead, tin and the like—will be thrown down to settle at the bottom of the jar. Lighter metals, such as iron and aluminum, will not be thrown down.

If possible, test the solution after a few hours or days, to find out whether all the gold has been thrown down or not. There is a book called "Testing Precious Metals" which tells how to do this; we can supply it if you wish to purchase it.

As soon as you are sure that all the precious metal has been thrown down, and that the liquid contains nothing of value, the next step is to pour this liquid off and throw it away. The heavy mud at the bottom of the jar will contain all the value.

Catch the heavy mud in a filter paper, and wash off as much of the liquid as possible.

This mud, which contains all the value, also contains more or less base metal and dirt, depending upon what was in your solution when you started. Possibly your best procedure would be to sell this, after it is dry, to a refiner, or exchange it for new gold or silver. Or, you could refine it yourself.

To obtain fine gold from this heavy mud might be easy or might be difficult—so much depends upon what dirt and base metals are present, as well as on your equipment. Briefly, to obtain fine gold you would first wash this mud well, then dissolve it in aqua regia (a mixture of nitric and hydrochloric acids), filter off any insoluble parts and throw them away, then recover the dissolved gold. This last step is usually accomplished by adding a solution of copperas to the aqua regia solution; copperas reacts with the dissolved gold and throws it down in the form of a brown powder. This brown powder is collected, washed carefully, and melted down. In most cases this gives a button of fine gold of high quality. However, as we have already suggested, the kind or quantity of impurities present are always important factors in this process, and if, for example, your original solution contained lead or tin, the button might be brittle or defective. This fact will serve to explain why we said, above, that in order to obtain best results it is necessary to know the kind of solution involved, and to adapt your method to the individual case.—**Jewelry Metallurgist.**

Editorial Comment

Go to the Platers' Convention

FIRST and foremost our injunction to readers who are in any way, directly or indirectly, interested in metal finishing, is to attend the convention of the American Electro-Platers' Society in Cleveland, Ohio, June 1-4. Between the strong technical and educational program and the exhibit of metal finishing equipment and supplies, a year's education can be packed into four days. Full details of the program will be found on pages 161-167 of this issue.

For members of the Society this meeting is of outstanding importance. The Baltimore-Washington Branch has given notice that it will sponsor a motion to amend the Constitution of the Society to provide for the employment of a full-time Executive Secretary to perform the present duties of Secretary and Editor, and other duties pertaining to Headquarters Office of the Society. In other words, for the first time in its history, the Society will consider employing a full-time executive to take charge of its operations.

In principle such a step calls for nothing but praise. In practice it calls for careful consideration and wise planning. It will require the best thought of every member of the organization.

Again we urge our readers to attend the convention without fail.

New Corporation Taxes

THE proposed revised corporation taxes to be laid by the Federal Government have been occupying front page space in the daily press for some weeks. The plan as originally laid down was to repeal all existing corporation taxes and capital stock taxes, and to substitute taxes on undistributed earnings. This would help to encourage the payment of more of the earnings as dividends to stockholders.

It seems to be the general opinion that corporations would pay less in direct taxes than at present, that the direct yield to the Government from this tax might be comparatively small but that the large increase would come from stockholders taxed on dividends as income which is now exempt. It has been estimated by those in the Administration in favor of this type of tax that a total yield of about $1,600,000,000 would result as compared with about $1,000,000,000 under the present taxes.

The above proposals have excited a great deal of controversy but, interestingly enough, much less attack than might have been expected. There is considerable doubt about the Treasury estimate of the yield of $1,600,000,000 and there is also a feeling that the proposals will be modified considerably before the bill is eventually passed.

Fundamentally of course, it is another step in the plan to tax the rich or the comparatively rich, which is to be expected, especially with a presidential election directly ahead.

Silverware Apprenticeship Program

THE jewelry manufacturers of New England have formulated a set of proposed terms for apprentices. This institution fills a long needed want. As a guide to other industries with similar plans, we give below in brief, the terms of apprenticeship.

Apprentices, at least 16 years of age, serve three years or a total of 6,000 working hours. The pay is graduated from 25 cents per hour for the first thousand hours to 37½ cents per hour for the last. A fund is created by the deduction of 50 cents per week from each employee's wages, and in addition thereto of an equal amount by the employer; the fund to be paid to the apprentice at the conclusion of his indenture. Each apprentice is furnished with a course of study at the Rhode Island School of Design, to be paid for 1/3 by the apprentice, 1/3 by the employer and 1/3 by the New England Manufacturing Jewelers and Silversmiths Association.

This program, developed by above mentioned Association and the Metal Finding Manufacturers Association, is the first comprehensive step which has come to our attention for providing a source of skilled help in a trade which has long needed it. The example may well be followed by other branches of the metal industries.

Markets for Plating

WE ALL know that electroplated work has markets in an almost innumerable variety of fields, and that it stands to profit (or lose) by any expansion or contraction in these fields. However, an interesting circular from the Master Electro-Platers Institute of the United States brings to our attention forcibly the opportunities for electroplating in the immediate future: increased activity in housing, expanding production of electric refrigerators, gas ranges, washing machines, vacuum cleaners, radios, toys and playground equipment, bicycles, oil burners, air-conditioning equipment, steel furniture, etc.

So far so good. These are products which are known to be growing at this time. The Institute points out, however, that the electroplating industry is not taking advantage of this situation as it should. It has no publicity and advertising campaign to make manufacturers and the public conscious of the effectiveness of electroplated finishes in their homes, on their furniture and fittings and on their household equipment. Stainless steel is advertising hugely; preplated strip (already an important factor in the industry) is viewed as a real competitor of electroplating installations for finishing fabricated products.

The electroplating industry has ammunition to spare. Second to none, it has developed new methods and processes of widespread interest in number, type and quality; witness two or three examples like chromium, bright nickel, bright zinc, etc. Technically, the industry is awake and alive. From a promotional standpoint, however, it is lagging.

What practical plans can be formulated to bring to the public the advantages of electroplating?

Correspondence and Discussion

Solution for Jet Black

To the Editor of **Metal Industry:**

I have used the following solutions to make a very pretty jet black, this solution will work on brass, bronze, copper and nickel silver. A deep black as demanded on modernistic designs, it will relieve easily and not require too much pressure, to get high lights.

Water	1 gal.
Muriatic acid, about 3%	8 ozs.
White arsenic	1 oz.
Oxide of iron (Fe_2O_3)	1 oz.
Sulphate of copper	1 oz.

Use steel anodes, Voltage, 1 to 3; Amperage, 5 to 15 per sq. ft.

In preparing, arsenic should be dissolved in full strength, muriatic acid, will take up thoroughly if acid is slightly warmed. If used for heavy production solution should be replenished frequently, the deposit is very rapid if solution is run at about 110 Fahr.

ANDREW V. RE.

Coldwater, Mich.

Casting Trouble Cured

To the Editor of **Metal Industry:**

We thank you for response to our inquiry in reference to casting difficulties which we have had. We are very glad to be able to say that we believe we have overcome these difficulties. We have found that the difficulties could be overcome by substantial changes which you suggested.

BALL and BALL.

West Chester, Pa.

New Books

Platers' Guidebook, 1936 Solutions Edition. Published by Metal Industry Publishing Company, 116 John Street, New York. Free to subscribers of **Metal Industry.** Will be ready for distribution between May 15th and May 20th. The booklet will be completely revised and brought up to date, and will have in addition, several new features covering departments of the electroplating and metal finishing industries which have never been included before.

The following topics will be covered: Polishing; Buffing; Coloring; Vapor degreasing; Solution for Nickel, Copper, Brass and Bronze, Zinc, Tin, Cadmium, Chromium, Lead, Iron, Silver, Gold, Rhodium, etc.; Methods of Chemical Analysis Including pH Determination; A List of Metallic Deposits and Their Properties; Metal Coloring including Anodic Oxidation; Ball Burnishing; Plating Room Tanks; Metallic Deposits and Their Properties; Tables of Electroplating Data, such as Conversion Factors, A List of Chemicals with their Technical and Trade Names, etc.

Plans are being made for extremely wide distribution of this (5th) edition, since the last (1935) edition, which was originally planned at 8,000 copies, met such a demand that a total of 12,000 were finally distributed.

The booklet needs no extended description as it is nationally known to be the best handy pocket volume of practical electroplating information ever published.

When requesting copies, please write on company stationery, giving the writer's official position.

Three Monographs on Color. 1. Color Chemistry; 2. Color as Light; 3. Color in Use. Published by the International Printing Ink Corporation, New York. In three volumes, 8¾ x 11¼; from 18 to 30 pages each. Price $10.00 in all.

These three handsomely bound monographs are designed to answer in type and by illustration, a wide variety of questions on a subject which has received little scientific attention, but is recognized to be of growing importance. It is pointed out that knowledge of color may save money through a striking color effect; a better color for a specific purpose; greater visibility where display is a factor and accurate specification of color matches.

The writers of these books are men in the various specialized laboratories of the publishers, such as the Pigments Laboratory, the Vehicle Laboratory, Physical Standards, etc. The companies which contributed to this group effort include the Ault and Wiborg Corporation, manufacturers of industrial finishes; Ault and Wiborg Carbon & Ribbon Company, Inc.; Ruxton Products, Inc.; United Color and Pigment Company, Inc., manufacturers of organic and inorganic pigment colors for paints, lacquers, inks, paper and linoleum; In-Tag Company, and International Printing Ink Corporation. Every manufacturer to whom color is important in his business, should own these books.

Technical Publications

Reprints of Paper Relating to the Properties of Oxygen-Free High Conductivity Copper: Comparative Properties of Oxygen-Free High Conductivity, Phosphorized and Tough-Pitch Coppers, by W. R. Webster, J. L. Christie and R. S. Pratt; Oxygen-Free High Conductivity Copper: Its Properties and Uses, by Sidney Rolle and P. H. Brace; OFHC Copper Castings; Specifications for OFHC Copper. United States Metals Refining Company, Oxygen-Free Copper Department, 420 Lexington Avenue, New York.

Striations in Tin Coatings on Copper, by Bruce Chalmers and W. D. Jones. Series A. No. 23. International Tin Research and Development Council, 149 Broadway, New York.

Electrodeposition of Tin Alloys from Alkaline Stannate Baths, by R. G. Monk and H. J. T. Ellingham. Series A. Number 25. International Tin Research and Development Council, 149 Broadway, New York.

The Atmospheric Corrosion and Tarnishing of Tin, by L. Kenworthy. Series A. No. 24. International Tin Research and Development Council, 149 Broadway, New York.

Mechanical Properties of Tin-Base Alloys, by D. J. MacNaughtan. International Tin Research and Development Council, 149 Broadway, New York.

Electrodeposition of Bronze Using Bronze Anodes, by S. Baier and D. J. MacNaughtan. International Tin Research and Development Council, 149 Broadway, New York.

Tin and Its Uses, by D. J. MacNaughtan. International Tin Research and Development Council, 149 Broadway, New York.

Tin and Civilization, by D. J. MacNaughtan. International Tin Research and Development Council, 149 Broadway, New York.

Use of Lithium Chloride for Air Conditioning, by Dr. F. R. Bichowsky. Foot-Prints, December, 1935, published by the Foote Mineral Company, 16th and Summer Streets, Philadelphia, Pa.

Determination of Gallium in Aluminum, by J. A. Scherrer. Research Paper RP853. National Bureau of Standards. For sale by Superintendent of Documents, Washington, D. C. Price 5 cents.

Accelerated Service Tests of Pintle Bearings, by Ambrose H. Stang and Leroy R. Sweetman. Research Paper RP 854. National Bureau of Standards, Washington, D. C.

The Influence of Thin Metal Layers on the Deterioration of Technical Insulating Oils, by P. J. Haringhuizen and D. A. Was. Technical Publications of the International Tin Research and Development Council. Series A. Number 29. International Tin Research and Development Council, 149 Broadway, New York.

Shop Problems

This Department Will Answer Questions Relating to Shop Practice

METALLURGICAL, FOUNDRY, ROLLING MILL, MECHANICAL, ELECTRO-PLATING, POLISHING, AND METAL FINISHING

Associate Editors

H. M. ST. JOHN
W. J. PETTIS
W. J. REARDON
W. B. FRANCIS
T. H. CHAMBERLAIN
WALTER FRAINE
G. BYRON HOGABOOM

Buffing Sterling Silver

Q.—Will you please let me know how they sand buff Sterling silver ware in the eastern manufacturing plants; kind of buff-sand or pumice stone, speed of machine, any information on this subject will be appreciated.

A.—The methods used in sand buffing of Sterling silver vary somewhat according to size and shape of articles to be finished. A common practice is to use a cotton wheel 6" diam. traveling at 3,500 R.P.M. The abrasive used is grade F. pumice mixed with machine oil to the consistency of a thick paste. Walrus hide wheels of same diam. can be used to advantage with a speed of 1,200 R.P.M. using Grade ½O pumice mixed as above.

—T. H. C., Problem 5,488.

Copper Dip

Q.—We are sending you under separate cover a chain. We would appreciate it very much if you would tell us what finish this is and how it is made. Also, let us know if this is dipped or tumbled.

A.—The sample has been dipped in a copper sulphate solution composed of:

Copper sulphate	2 ozs./gal.
Sulphuric acid	1 fluid oz./gal.

The work must, of course, be clean before placing in this dip.

The finish, or luster, obtained will depend on the finish of the base metal wire. This can be improved by ball rolling if necessary.

The work can be dipped in aluminum baskets.

—G. B. H. Jr., Problem 5,489.

Cyanide Copper

Q.—Could you please tell me if copper cyanide, ½ lb. to the gallon of water is the proper think to use for a dip for copper and brass before plating?

Could you give me the correct method for mixing copper cyanide and sodium cyanide for making a copper solution? What is the proper amount per gallon to use, when operated at 80° F.?

A.—A cyanide dip is often used on brass and copper work before plating. Ordinarily, however, the dip need not be as strong as you mention. Two to four ounces to the gallon of sodium cyanide should be sufficient. The preferable procedure, however, is to so clean the work that it does not tarnish and therefore does not require a cyanide dip.

In using a cyanide dip there is the danger of not thoroughly rinsing the work before entering the nickel solution. Any traces of cyanide left on the work will cause the nickel deposit to peel or blister. If cyanide must be used it can be rinsed off in clear water and then neutralized in a nickel acid dip, that is, a dip composed of some regular nickel solution to which some acid has been added—enough sulphuric acid to bring the pH down to about 5.2.

Formula for a cyanide copper solution:

Copper cyanide	3.0 ozs./gal.
Sodium cyanide	4.5 ozs./gal.
Sodium carbonate	2.0 ozs./gal.

First make a paste of the copper cyanide and water. Then add the sodium cyanide, and finally the carbonate. In adding sodium carbonate it should not be thrown in by the scoopful but should be spread around with stirring. If thrown in it will lump up and take some time to dissolve.

—G. B. H. Jr., Problem 5,490.

Gold Solution

Q.—Where can I get information about a gold bath employing yellow prussiate of potash?

A.—A solution made up as follows using yellow prussiate of potash will give satisfactory results:

Potassium ferro-cyanide (yellow prussiate of potash)	4 ozs.
Sodium carbonate	4 ozs.
Gold as fulminate	12 dwt.
Water	1 gal.
Volts	2
Temperature	120-140 deg. F.
Anodes	24 kt. gold

Boil solution for 30 minutes and filter.

—T. H. C., Problem 5,491.

Insufficient Nickel Deposit

Q.—Under separate cover we are mailing you a sample of our nickel plate barrel solution with which we have had considerable trouble.

We have filled out the inclosed blank which we trust will give you all the necessary information for analyzing this solution.

We are inclosing samples of our screws before nickel plating and after. We would like to have this solution tested.

USE THIS BLANK FOR SOLUTION ANALYSIS INFORMATION

Fill in all items if possible.

Date.....

Name ..... Class of work being plated: .....

Address ..... Volume used: .....

Employed by: ..... Solution depth: .....

Kind of solution: ..... Cathode surface, sq. ft.: .....

Tank length: ..... width: ..... Kind of anodes: .....

Anode surface, sq. ft.: ..... Distance from cathode ..... Original formula of solution: .....

REMARKS: Describe trouble completely. Give cleaning methods employed. Send small sample of work showing defect if possible. Use separate sheet if necessary. _____

NOTE: Before taking sample of solution, bring it to proper operating level with water; stir thoroughly; take sample in 2 or 3 oz. clean bottle; label bottle with name of solution and name of sender. PACK IT PROPERLY and mail to METAL INDUSTRY, 116 John Street, New York City.

A.—The analysis of the solution is as follows:

Nickel	5.30 ozs./gal.
Chloride, as ammon. chloride	2.40 ozs/gal.
pH	6.0

The nickel is slightly high but this solution should work all right in a barrel.

From the appearance of the work you sent it looks as though insufficient metal was being applied. Look to the current being sent through the barrel. Examine all connections outside of the barrel and check over the contacts inside the barrel. If danglers or contacts are built up with nickel replace them. Check over the anodes.

The current drawn by the barrel you mention should be approximately 100 to 125 amperes.

—G. B. H. Jr., Problem 5,492.

Nickel Consumption

Q.—We are sending you under separate cover a sample of our nickel plating solution. Our tank is 13 feet long, 2 feet wide and 3 feet deep. The distance between the anode and the cathode is 10 inches. We use 15 anodes each 30" long, 95%-97% pure. We use salt to maintain our chloride content. Now the trouble with our bath is that the anodes consumed too rapidly.

We plate brass plumbing supplies and use it for an average of six hours a day, five days a week. We have no trouble but, we have to replenish our anodes every six months.

A.—Analysis of nickel solution:

Nickel	2.42 ozs./gal.
Chloride, as sod. chloride	4.95 ozs./gal.
pH	5.7

The nickel is too low and the chloride is unnecessarily high for a solution using 95-97 anodes. Add 3.0 ozs./gal. of single nickel salts to bring up nickel content. No further additions of chloride should be made for some time.

You will find from an electrolytic deposit table that for every 100 ampere hours of current passed through a solution there will be dissolved 3.9 ounces of nickel, theoretically. Actually somewhat more weight will be lost from the anode due to sludge and metallic particles falling off.

If we start with the assumption that the tank is drawing 100 amperes on the average during the day then about 4 ozs. of nickel anode is being used up each hour. That means 120 ounces per week of 30 hours or 7½ lbs. per week. For a period of 25 weeks the consumption would be 187½ lbs.

If the average current through the tank is greater than 100 amperes the consumption will be higher in proportion, assuming approximately equal anode efficiency. If much more nickel is being used than these figures show then the proper anode corrosion is not being obtained.

This calculation does not include drag-out losses.

—G. B. H. Jr., Problem 5,493.

Nickel Solution Analysis

Q.—Under separate cover I am shipping you samples of two nickel solutions for analysis.

Will you please analyze them for metal, chlorides, boric acid and pH.

A.—The results of the analysis are:

	No. 1 Nickel	No. 2 Nickel
Nickel	1.97 ozs./gal.	2.05 ozs./gal.
Chloride as ammonium chloride	.49 ozs./gal.	.52 ozs./gal.
pH	5.2	5.7

Nickel and chlorides are both low.

To No. 1 solution add 5 ozs./gal. of single nickel salts and 2½ ozs./gal. of ammonium chloride.

The same additions should be made to No. 2 solution.

The pH of number one solution is too low. Add 2½ fluid ounces of ammonia to each 100 gallons of solution.

The pH of the solutions should be checked after adding the salts.

—G. B. H. Jr., Problem 5,494.

Oxidizing Ornamental Bronze

Q.—I would greatly appreciate any information you can furnish me on formulas for oxidizing ornamental bronze to (1) verde green and (2) brown finish. Are these finishes permanent for outdoor work? Does rain leave water spots?

Is a coat of lacquer and wax necessary after oxidizing? If so, what wax formula do you recommend without darkening the verde-green finish? I would also appreciate the formulas for oxidizing bronze by sawdust.

A.—One formula for a verde antique finish is:

Copper nitrate	4 ozs.
Ammonium chloride	4 ozs.
Copper chloride	4 ozs.
Water	1 gal.

This solution is applied to the metal surface by stippling on with a bristle brush.

In using the sawdust method the sawdust is made moist with the corroding solution. Then the pieces are buried in the mass and allowed to stand for some time, depending on the depth of finish desired.

The antique finishes are most easily protected by means of a clear lacquer. Wax can be used, but some change in color will be produced. Use beeswax and carnauba.

A brown finish can be obtained by the use of a weak solution, used as a dip, of potassium or ammonium sulfides or of "liquid sulphur". The concentrations are usually ¼ to ½ oz. per gal.

—G. B. H. Jr., Problem 5,495.

Pitted Nickel

Q.—Would appreciate your report on the 8 ounce bottle of nickel solution sent you a few days ago.

This solution stands at a Baume of 17, whereas when it was first made up it stood at 10. We recently installed a set of 99% plus depolarized anodes, would these have a tendency to build up the Baume? I have tried to cut it back to 10, but this reduces my nickel content considerably.

I am running this solution for aluminum which is plated for one and one-half hours, and I so desire to keep the metal content at 18 ounces per gallon. We are troubled with pitting, we use about one gallon of hydrogen peroxide to 300 gallons, this overcomes the pitting for a few days, but the throwing power is far less, and as the hydrogen peroxide works out the throwing power increases.

A.—The nickel solution analyzes:

Nickel	3.77 ozs./gal.
Chloride, as amm. chloride	2.79 ozs./gal.
pH	5.9

This solution should operate satisfactorily. The chloride can be brought up to 3.0 ounces by adding ¼ ounce per gallon of ammonium chloride. Since you state the only trouble is pitting we recommend the use of hydrogen peroxide be continued. Rather than add a large amount of peroxide at one time add a small amount daily, preferably at the end of the day when the solution can be given a chance to settle after stirring in the peroxide.

Excessive iron will cause pitting. The iron can be removed by precipitating it out with ammonia and filtering.

The use of 99 plus anodes will not cause the Baume of the solution to increase.

—G. B. H. Jr., Problem 5,496.

Plating Over Type Metal

Q.—Kindly give me some advice on the following: I have cast a bronze figure (about 15 inches high) on which there were some blow holes that I filled with type metal. As I wish to color the figure with coloring acids, how can I treat the patched parts so that the coloring will be the same all over. A friend suggested copper plating all over.

A.—To be able to obtain a uniform finish it will be necessary to copper plate the entire article; otherwise, places that have been filled in with type metal will show. It is suggested that the castings be given at least a thirty minute deposit from a copper cyanide bath.

Care should be taken in cleaning the castings filled with type metal. A mild electro-cleaner should be used if possible using both direct and reverse current at 12 volts. If a still cleaner is used it may be necessary to brush filled spots to remove scum to obtain good bonding of plate.

—T. H. C., Problem 5,497.

Practical Brass Foundry Digest

By H. M. ST. JOHN
Chief Metallurgist, Detroit Lubricator Company; Associate Editor, METAL INDUSTRY.

Short Abstracts of Articles of Interest to Practical Non-Ferrous Foundrymen and Metallurgists.

Industrial Health Hazards and Employer Responsibility. W. J. McConnell. Trans. Amer. Foundrymen's Assoc., Vol. VII, page 161 (Feb. 1936). Discussion, on page 180.

The Assistant Medical Director of the Metropolitan Life Insurance Company discusses occupational hazards in the foundry and recommends in each industrial center a central bureau for examining workers. Varying temperatures and exposure to heat and drafts are more serious dangers than dust, although the latter is legally important.

Dust Collection in the Foundry. S. D. Moxley. Trans. Amer. Foundrymen's Assoc., Vol. VII, page 191 (Feb. 1936). Discussion on page 222.

The use of hoods and dust collecting systems is discussed in considerable detail.

Methods of Dust Control. J. D. Leitch. Trans. Amer. Foundrymen's Assoc., Vol. VII, page 209 (Feb. 1936). Discussion on page 222.

A general discussion of equipment and methods.

Recommended Procedure for Analysis of Defects in Brass and Bronze Sand Castings. H. M. St. John et al. Trans. Amer. Foundrymen's Assoc., Vol. VII, page 247 (Feb. 1936).

An outline of the work undertaken by an A. F. A. Committee, intended to systematize the diagnosis of foundry defects and prescribe remedies for each.

Deoxidation and Degasification of Nickel Silver Alloys. R. J. Keeley. Trans. Amer. Foundrymen's Assoc., Vol. VII, page 251 (Feb. 1936).

Gas porosity and non-metallic inclusions are the two defects most frequently encountered in nickel-silver castings. When melted under reducing conditions there is a strong tendency toward gas absorption, hydrogen being particularly troublesome. Sufficiently high pouring temperatures (2500° F for a 20% nickel alloy) are necessary to promote the cleansing effect of the zinc and to minimize dross inclusions. The use of coke having a high sulphur content is sometimes a cause of gas porosity. Up to 3% aluminum may be used in the composition of alloys for structural parts of uniform section but its presence in any amount is objectionable in castings which must be pressure tight. Silicon in small proportions (0.25%) is a useful deoxidizer in alloys containing less than 2.50% lead. Heavier gates and risers are necessary when either aluminum or silicon is present. Castings containing higher proportions of lead are deoxidized by the use of 0.10% manganese followed by 0.05% magnesium. In discussion T. E. Kihlgren emphasized the deleterious effects of silicon and questioned its use even in low-lead nickel silvers, because of its tendency to produce a loose, open structure. Mr. Keeley felt that the formation of lead silicide was the most important consideration.

The "Modifying" Phenomenon and Its Probable Relation to Properties of Non-Ferrous Alloys. C. H. Lorig and R. W. Dayton. Trans. Amer. Foundrymen's Assoc., Vol. VII, page 262 (Feb. 1936).

The authors apply to non-ferrous alloys the "slag-cloud" hypothesis which has been offered as an explanation for peculiarities of graphite formation in cast iron. It is thought that the presence in the molten metal of minute non-metallic particles which act as crystal nuclei may prevent under cooling and thus result in a coarse, dendritic structure. This in turn may explain astonishing variations in the properties of cast alloys which otherwise seem to be practically identical. A "modifier" is a substance which decreases the number of these hypothetical nuclei or masks their effect and thus permits undercooling to take place. The well known modifying action of sodium and sodium fluoride on certain aluminum alloys may be explained in this way. In general, superheating the molten metal seems to destroy the effect of the slag cloud. Many strong deoxidizers seem also to be efficient modifiers. It is probable that brasses and bronzes are susceptible to modifying action although there is little direct evidence. The problem is a very involved one since the modified state of the molten metal is unstable and strongly influenced by stirring, superheating, slow cooling and other variations in treatment. In discussion it was pointed out that, in some instances, the presence of many slag particles probably obstructs grain growth and results in a fine-grained structure which might at other times be caused by the absence of slag particles and resultant undercooling.

Beryllium and Beryllium Alloys. M.G. Corson and J. D. Zeiser. Iron Age, Vol. 137, page 28 (March 5th, 1936).

Pure beryllium is known to have a silvery gray color and is noticeably crystalline but has not yet been cast in such form as to make possible a study of its physical properties. It alloys with silver, aluminum and tin, also with copper, nickel, cobalt, iron and platinum. All of the alloys so far investigated are capable of age hardening. Pure nickel and nickel-chromium alloys are usefully hardened by less than 2% beryllium. Properties of several alloys are given including "Contracid," an industrial alloy developed in Germany which contains approximately 60% nickel, 15% chromium, 15% iron, 7% molybdenum, 2% manganese and 0.6% beryllium. Beryllium copper alloys usually contain about 2.5% beryllium and can be hardened to 365 Brinell by a combination of cold working and heat treatment. Beryllium-copper castings are used in the manufacture of non-sparking safety tools and offer promise of several other useful applications. A special melting and casting technique (which the authors describe) is required. Quenched from a 2-to-3 hour heat treatment at 1475° F the castings are about 100 Brinell and are easily machinable. They are then hardened by quenching from 575° F after a treatment of from 1 to 5 hours, depending upon the hardness desired, which may vary from Brinell 225 to nearly 400. Water quenching is generally used for castings with light sections although an oil quench gives greater toughness without sacrificing much hardness.

Some Applications of X-Rays to Industrial Problems. J. R. Townsend and L. E. Abbott. Metal Progress, Vol. 29, page 64 (Feb. 1936).

The use of X-rays in the investigation of casting defects is discussed and illustrated at considerable length. Gas pockets in die castings can be detected effectively to assist in the study of casting technique. Internal stress and corrosion in brass can also be identified. The non-destructive nature of the test greatly recommends it for many applications.

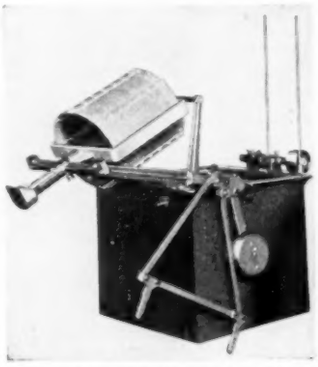
Modern Equipment

New and Useful Devices, Metals, Machinery and Supplies.

New Plating Machine

A new machine designed to reduce the cost of plating small articles in bulk has been introduced by the Daniels Plating Machine Company, of Newark, N. J.

The machine consists of a rubber-lined steel tank to contain the solution, and an insulated perforated container to receive the articles to be plated mounted to the tank about one shaft for rotation and another shaft for oscillation so that the container can be rotated selectively while suspended in the solution. The container is removed upward for filling, discharging and inspecting the articles being plated without disconnecting or removing the container from the mountings. The machine operates rapidly, it is claimed, due to a novel feature in the design of the conductor frame. This frame has a four point contact so placed in the bottom of the container that the current is equally distributed to all articles being plated, resulting in a uniform deposit, and, it is stated, entirely eliminating the depositing or treeing of metal on any part of the machine.



Daniels Plating Machine

Removal of Buffing and Polishing Compounds

A new type of water soluble solvent has recently been developed by the Quaker Chemical Products Corporation of Conshohocken, Pa. This new product is dissolved in water in the proportion of 1 part of material to anywhere from 4 to 6 parts of water depending on the job to be handled.

For removing polishing and buffing compounds the solution is usually made up in proportions of 1 to 5 parts of water. It is stated that the most intricate buffed work can be immersed in this solution at temperatures about 160 to 180 deg. F. and after an immersion of from 1 to 5 minutes depending on the difficulty of the job the work can be removed, rinsed in water and immediately put through the regular alkaline cleaning cycle without any necessity of wiping, brushing or degreasing.

This new development is called Quaker Solvenol No. 5. The chief advantages claimed are that: (1) it permits rapid and thorough removal of buffing and polishing compounds; (2) it cannot tarnish the most highly oxidizable metal; (3) it does not change through age as soaps and alkalies do; (4) it is slightly acid in nature and, therefore, can never tarnish; (5) it cleans by solution which makes for great economy; (6) the oils float to the top of the bath and are skimmed off whereas the inert material settles to the bottom and the Solvenol No. 5 bath, therefore, has extremely long life, the only loss being due to drag-out.

Solvenol No. 5 is being used on intricate automotive work and removing buffing compounds from die castings and polishing compounds from steel. The usual cycle is a 2 minute immersion in a Solvenol No. 5 bath followed by a rinse and 1 minute in the electric cleaner. It is stated that all brushing has been eliminated with the use of this process.

Latest Products

Each month the new products or services announced by companies in the metal and finishing equipment, supply and allied lines will be given brief mention here. More extended notices may appear later on any or all of these. In the meantime, complete data can be obtained from the companies mentioned.

Small Bulb Gas-Filled Thermometer. A recording thermometer having a small temperature-sensitive bulb for measuring temperatures from —60°F to 1000°F; tubing lengths as long as 100 feet. Bristol Company, Waterbury, Conn.

Metal Bord. A pre-finished metal sheet affixed to a non-metallic backing. Recommended for buttons, buckles, dress ornaments, signs, advertising specialties, display devices, etc. American Nickeloid Co., Peru, Ill.

Portable Cable Accessories; couplers, terminals, etc. General Electric Co., Schenectady, N. Y.

Duplex Hose. Twin hose, simultaneously molded with a connecting web between them, called "Supero." Electric Hose and Rubber Company, Wilmington, Dela.

"Deep Throat" Model J D "Do-All" Machine. For internal and external precision band sawing with narrow blade band saws; also band filing and band polishing. Continental Machine Specialties, Inc., 1301 Washington Avenue, S., Minneapolis, Minn.

Sealer for Corrugated and Fibre Shipping Containers. Eliminates the glue problem and reduces damage in transit losses. Paslode Company, 288A No. Bank Drive, Chicago, Ill.

Recording Voltmeter. Strip chart recording instrument, simple in design and much lower in price. Type CD-23 and CD-24. General Electric Company, Schenectady, N. Y.

"Protectoglo" System of Combustion Safeguard. Brown Instrument Company, Philadelphia, Pa.

Non-Ferrous Expansion Plugs. Brass, copper, aluminum, stainless steel, Monel metal, etc. Wrought Washer Mfg. Company, Milwaukee, Wisc.

Unitair Compressors; two-stage, completely air-cooled V type, single acting stationary. Sullivan Machinery Company, Dept., 21, Michigan City, Ind.

Bench Model "Do-All" Machine. For band sawing, band filing and band polishing. Continental Machine Specialties, Inc., 1301 Washington Avenue, S., Minneapolis, Minn.

Electromode Convection Heater; ¾ K.W. unit which utilizes the natural rise of warm air for circulation. American Foundry Equipment Company, 408 Byrkit Street, Mishawaka, Ind.

Oxy-Acetlyene Cutting Attachment; wide range of work from light sheet metal to all but the heaviest types of work. Type CW-22. Linde Air Products Company, 205 East 42nd Street, New York.

"Thermo-Grip" Pliers. For removing solder lugs and for making sweated joints in the new type copper pipes and fittings. Ideal Commutator Dresser Company, Sycamore, Ill.

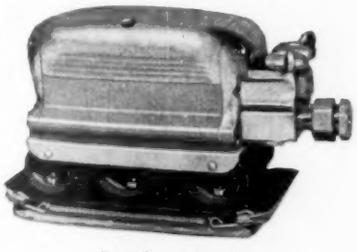
Skilsaw Drills; new models; special duty ¼ in. drill and two models known as Defender drills. Skilsaw, Inc., 3345 Elston Ave., Chicago, Ill.

Selfvulc "M" Bonding Solution; a primer for bonding rubber and other protective coatings to impervious surfaces like glass, metal, concrete, plaster, etc. Self-Vulcanizing Rubber Company, Inc., Rm. 515-J., 605 W. Washington Boulevard, Chicago, Ill.

New Type Safety Window, permitting the sash to be held inward at the midrail and at the top, in addition to sliding up and down in the conventional manner. Howard Safety Window Company, Inc., Milwaukee, Wis.

Improved Sander

The Sterling Products Company, Curtis Bldg., Detroit, Mich., has made major improvements which have greatly increased the usefulness of their Speed-Bloc Sander. This applies to both wet and dry sanding. Being designed primarily to replace hand sanding and rubbing, its application through these new developments has been increased tremendously. The Sterling is now recommended for more curved and all flat surfaces, metal, fabric, wood, composition or marble; from such delicate operations as the surfacing of stringed instruments to the finishing of machine tools, new streamlined trains and auto bodies. All of these applications have been made possible because of redesign of the sanding pad and block.



Sterling Sander

The sanding block is now made of five parts instead of one. Parts subject to greatest wear are readily and cheaply replaced. A hardened steel shoe which receives the thrust is now vulcanized integrally with the rubber bloc instead of being held by screws.

Improvements in the air motor have not only made it a smoother operating unit, but air consumption has also been decreased. Full operation is now accomplished with 50 to 60 lbs., instead of 70 lbs., and delivery of power at top of torque has been measurably increased, yet air consumption is still within original limits of slightly over 6 cubic feet per minute.

The oscillating stroke of the pad is 5/8 of an inch, and the speed remains at 3,000 strokes per minute. There is no chasing or graining.

The weight of the complete sander is 7½ lbs. Overall dimension: 7" long, 4¾" high, and 3¾" wide. A standard sheet of abrasive paper cut in three equal parts fits the pad.

Perhaps no other class of furniture has to stand as hard usage as steel office furniture. One of the leading paint manufacturers found after long experimenting that the only paint which would withstand rough treatment on steel office furniture was made with synthetic vehicles. According to M. S. Fellowes, Factory Manager of the Steel Equipment Company, Ltd., Pembroke, Ont., Can., Sterling sanders now play a very important part in the maintenance of a constant flow of material to the spray booths, and have paid for themselves many times over in the savings which have been effected by their installation.

Testing Service

In our April issue, page 149 we published a description of the testing service carried on by the South Florida Test Service, Box 387, Miami, Fla. This article gave the mistaken impression that this service is new. We are informed that the company is now in its fifth year of operation, having been established in May, 1932, and that they are serving more than 100 leading industrial firms in the United States in various industries.

Korolac Dipping Tanks

Making it possible for the user to insulate plating racks in his own plant, the J. C. Miller Company, Grand Rapids, Michigan, is manufacturing a Korolac Dipping Tank in four standard sizes which has been approved by the B. F. Goodrich Company for use with their Korolac process.

Korolac is the new rubber-like material for plating rack insulation for use in all acid or alkali plating baths, alkali cleaners and acid dips. The Miller Korolac Tank is said to give utmost heating efficiency and minimum solvent loss, embracing in its mechanical features an inner tank lining of porcelain. It comes with either steam coils or electrical heating units and temperature regulators fitted with a ready-to-install new-type ventilating hood.

Fast Production Spray Gun

Greater speed, less air consumption, perfect atomization these are some of the improvements claimed for the Binks new Thor Model 7 Spray Gun. The latest achievement of a company that has been making spray guns since 1893, the Thor Model 7 includes the suggestions of engineers of some of the country's largest industries, where smart finishing must be obtained at the lowest possible cost.

Thor Model 7 Spray Gun

A departure from all other spray guns is the introduction of color into the gun body which is a durable drop forged aluminum with a black electrolytic coating for surface protection.

Full details on the new Thor Model 7 can be obtained from the Binks Manufacturing Company, 3114 Carroll Ave., Chicago, Illinois.

Buffing Compositions

A line of buffing compositions has been placed on the market by J. C. Miller Company, 528 Lake Michigan Drive, N. W., Grand Rapids, Mich., covering a wide variety of finishes. The Miller compositions include chrome rouge, stainless steel rouge, Tripoli, emery cake, emery paste, grease stick, lime finish, etc.

Wheelabrator Line Exhibited at Foundry Show

A complete line of Wheelabrators was exhibited by The American Foundry Equipment Company, 408 Byrkit Street, Mishawaka, Indiana, at the Foundry & Allied Industry Exposition, Detroit, Michigan, May 5th to 9th. Operating equipment cleaning castings of all types, sizes and shapes was displayed.

This line of equipment included the Wheelabrator Tum-Blast, the Wheelabrator Multi-Rotary Table, Wheelabrator Cabinet, and the Wheelabrator Automatic Production Unit.

The American Dustube Collector was in operation in conjunction with the Wheelabrator equipment.

A second exhibit of non-operating equipment was in South Cass Hall and included core machines, rod machines, flasks, jackets and other equipment manufactured by the company.

Attendants at the Show were: **Verne E. Minich, O. A. Pfaff, L. L. Andrus, J. D. Alexander, C. L Benham, H. H. Haley, R. J. Hutchinson, C. F. Ludwig, E. A. Rich, E. B. Rich, James Rigby, F. G. Schultz, E. J. Turnbull, Geo. H. Walsh, and Martin H. Kidder,** in charge of the exhibit.

Wheelabrator at Foundry Show

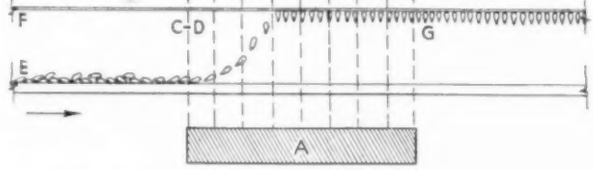
Electrocoated Sandpaper

The Behr - Manning Corporation, Troy, N. Y., has put into operation a new process of manufacturing sandpaper and other abrasive papers, the principle of which is electrostatic deposition of the abrasive on the backing. This process is covered by patents granted to E. C. Schacht, factory manager and assigned by him to the corporation.

One of the advantages claimed for this process is that the abrasive grains are deposited and affixed to the backing in the proper position, that is standing on end with the sharpest edges toward the work. Since these grains are two or three times as long as they are wide or thick, they are in a position to do better work and give longer service. The method employed is to pass the backing with its adhesive coating facing downward through the electrostatic field. The mineral particles are brought by a traveling belt between two electrodes propelled onto the adhesive coated backing, and stick there.

The illustration shows clearly the principles of the process.

Principles of Electrocoated Sandpaper Manufacture



Metallic Coating

Amco metallic coating, Brand "A" pure tin and Brand "E" zinc is a preparation that is recommended for replacing tinned or galvanized surfaces that have been worn, damaged or burnt away by welding, etc. After the powder has been sprinkled on the metal surface the resulting coating is said to be equal to the hot dip process and to stand all the tests that such coatings are subject to.

Amco metallic coating, it is claimed, is particularly adaptable to the repair of damaged surfaces on large equipment or on shipboard, or wherever a repaired coating is required that is either too cumbersome or expensive to ship to be hot dipped, or where a galvanized pipe or railing is welded at the point of construction. The material, it is stated requires no special preparation such as pickling, cleaning, etc., and will penetrate through rust, grease or paint.

The manufacturers are the American Solder & Flux Company, Wayne Ave. & Berkley St., Philadelphia, Pa.

Chromium Plating Anodes

A new type of chromium plating anode is being manufactured by J. C. Miller Company, 528 Lake Michigan Drive, N. W., Grand Rapids, Mich., with some unusual features. The anodes are made of tellurium lead with a corrugated surface to increase the electrical efficiency. They are supplied in one piece construction, together with the hooks; have knife edge contacts to insure positive connection with the anode bus bar. The hooks are made of copper, fully sheathed for resistance to corrosion.

New Aluminum Alloy

A recent development in the aluminum casting field, Titanite, a strong aluminum casting alloy, is now being manufactured by The Aluminum Smelting & Refining Company of Cleveland under patents owned by the Titanite Alloys Corp. also of Cleveland.

Titanite is an aluminum, manganese, titanium alloy which, as sand cast, develops 29,000 ultimate tensile strength with 6% elongation. Through the proper aging treatment the ultimate tensile strength increases to around 31,000 pounds with 4 to 5% elongation and a yield point of 25,000 to 28,000 pounds.

This alloy is said to be successfully competing with the heat treated aluminum alloys and to provide a means whereby strong aluminum castings can be produced by any foundry at considerable savings to the customer.

Titanite, owing to its high manganese content has, it is claimed, exceptional corrosion resistance as determined by the Cosma Laboratories of Cleveland. Other properties stated by the manufacturers are: it takes the anodic treatment successfully both as sand cast and as die cast; the machinability is nearly as good as the No. 12 Alloy and the machined surface is free from the intergranular porosity so often found on the surface of the 8% Copper Alloy.

No special foundry practice is necessary in handling Titanite although a somewhat higher pouring temperature may be found advisable along with larger risers than would be called for with No. 12.

New Filter Press

A new type of plate and filter press has been designed by the J. C. Miller Company, 528 Lake Michigan Drive, N. W., Grand Rapids, Mich., which it is stated, is built for pressure production filtration work. This press can be cleaned by reversing water through the cells without dismantling. It can be used for filtering nickel, copper cyanide, chrome, zinc and cadmium solutions.

A part of the unit is a diaphragm pump which it is stated, has the following features: no packing glands; simplicity of design; low maintenance costs; no priming necessary.

Capacity 1,000 gallons per hour, maintaining volume through filter pressure range.

A New Process for Protection of Aluminum

By A. EYLES

Mechanical Engineer

As is fairly well known, untreated surfaces of aluminum and aluminum base alloys have no natural affinity for paint, lacquer or enamel coatings, and such finishes if applied, will not be permanently adherent. The achievement of a solution to this problem has for some time occupied the attention of the metal finishing research laboratory of the Pyrene Company, Ltd., Great West Road, Brentford, Middlesex, England, and it is now claimed that a process has been discovered which successfully overcomes the difficulties.

Known as the "Pylumin" process, it is said to provide a cohesive base on aluminum and aluminum alloys for all types of paint, enamel or lacquer finishes, while the coating itself has a considerable resistance to corrosion without subsequent finishing.

The new process is very simple to operate and requires no electrical plant or skilled operators. Aluminum parts to be treated are simply immersed in a boiling solution consisting of "Pylumin" powder and water. The chemical action produced converts a microscopically thin portion of the metallic surface into such a state as to provide interstices into which the applied finish will flow. As the finish dries it is securely enclosed to the metal surface.

The combination of a "Pyluminized" surface and paint effectively, it is stated, seals the surface so that the metal is impervious to the most severe atmospheric conditions. An important characteristic claimed for the treated surface is effectiveness in preventing the spread of corrosion around any portion of the final finish which might become accidentally injured, corrosion is confined to the exposed area. Moreover, final finishes will not flake or peel off under shock or vibration.

"Pyluminizing" is accomplished in a heated tank, the size of which depends on the rate and amount of production required. The processing action is fast, requiring only three to ten minutes immersion in the boiling solution. Small production can be handled by means of baskets or racks in suitable tanks.

Full information can be obtained from the American affiliates, Pyrene Manufacturing Company, 560 Belmont Avenue, Newark, N. J.

Duriron Heat Exchanger

The heat exchanger made by the Duriron Company, Dayton, Ohio, is available in any of The Duriron Company's corrosion-resisting alloys—Duriron, Durichlor, Durimet, Durco Alloy Steels, Alcumite. Bulletins descriptive of each alloy are available upon request.

Construction

Referring to the "Tube Assembly" shown in the photograph, there are three nesting tubes inside a steam jacket (4).

The first tube (1) is a heating tube and has a closed end as shown in the picture on the left. The cover, not illustrated, is drilled and tapped for a 1" steam line and return line. This tube forms the inner heating unit.

The second tube (2) has baffles inside and out with alternating openings which cause the liquid to flow in a "split spiral" manner.

The third tube (3) envelopes the other two and transmits heat from the encircling steam jacket.

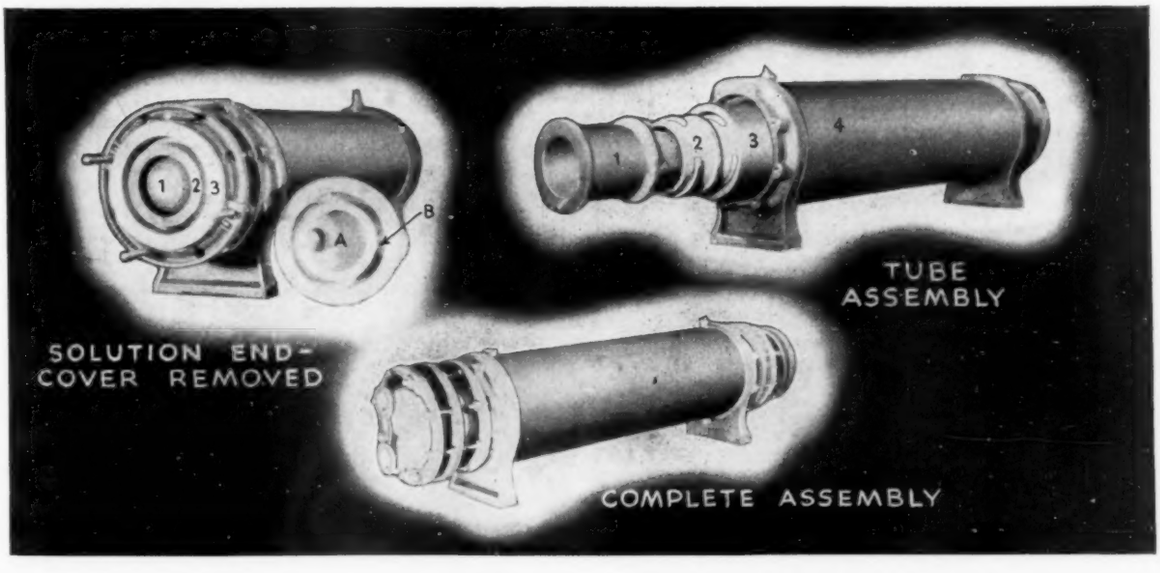
The photograph on the left illustrates the solution end. The liquid to be heated enters the heat exchanger through opening "A" of the cover, flowing between the first tube (1) and the baffle tube (2). It absorbs the transmitted heat from the inner heating unit.

The liquid reverses its direction at the end of the heat exchanger and returns between the second and third tubes, discharging through the outlet "B" of the cover. Heat is absorbed from the surrounding steam jacket (4).

All parts that come in contact with the corrosive liquids or gases are made of acid-resisting materials.

The 1" steam pipe and the steam jacket are made of ordinary steel. When the unit is used as a heat exchanger, where both the heating or cooling medium as well as the liquid to be heated or cooled are corrosive, the steam jacket and pipe as well as the tubes are made of corrosion-resisting alloys.

Dependent upon the solution to be heated or cooled, the temperature desired, and the heating or cooling medium available, the unit will satisfactorily handle from 10 to 50 gallons per minute. For greater capacities, sufficient units can be manifolded for either series or parallel flow.



Duriron Heat Exchanger

Applications

The Duriron Company Heat Exchanger is being used successfully in the heating of plating solutions. The usual practice is to pump the solution from the plating tank, through the filter and through the heat exchanger, before returning to the plating tank.

Still another application is the heating of metal pickling solutions where there is objection to the continuous use of live steam. This applies especially to enameling plants. Instead of using coils, the tanks are fitted with one or more Duriron Circulating Steam Jets. Live steam is used to bring the pickling bath up to operating temperature. After this temperature is reached and the pH of the bath corrected, the jets are turned off. The temperature of the bath is then maintained by circulating through the heat exchanger. Steam consumption is reduced and the maintenance cost is lower than if coils alone are used.

The Heat Exchanger is recommended for any acid heating job where dilution is undesirable and where close temperature control is essential.

New Plating Rack

A new type of high production plating rack has been designed and is being manufactured by the Kelly Plating Company, Rack Division, 10316 Madison Avenue, Cleveland, Ohio. This rack, which is designed specially for nickel and chromium plating screws, bolts, rivets and similar parts, will be on exhibition at the Convention of the American Electro-Platers' Society, June 1st-4th. It is rubber-covered, insulated against any deposit on the rack.

One of the special features is the hollow shield attached to the frame, which it is stated, prevents the building up of metal on the thread portion of the screw while permitting extra heavy deposits to be plated on the head. This allows plating to specification without the risk of tight threads.

It is stated that the rack requires only reasonable care to last almost indefinitely.

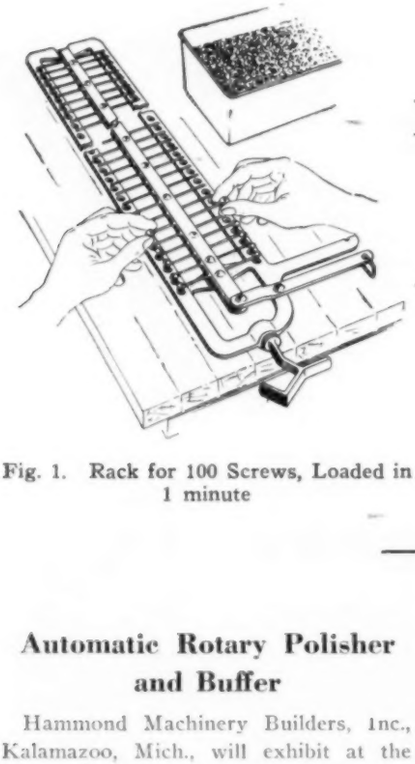


Fig. 1. Rack for 100 Screws, Loaded in 1 minute

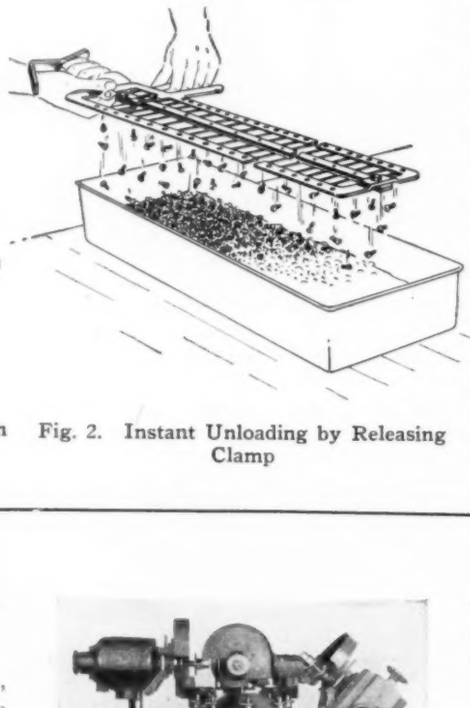


Fig. 2. Instant Unloading by Releasing Clamp

New Metal Coating

A new type of metal coating has been developed by Metalkote, Inc., 103 Park Avenue, New York, in which the methods of application and the properties are out of the ordinary. Metalkote is provided in the form of powdered metal held in a liquid. This metal-containing liquid can be applied to another metallic surface by dipping, spraying or painting. After application, the object is heated to the requisite temperature, depending upon the metal applied.

In appearance the material as provided resembles bronze paint, aluminum paint, etc. There, however, it is stated, the resemblance ends. A test recommended by the manufacturers is to quench the surfaced metal in cold water immediately after heating it to a red heat. It is stated that the metal coated surface remains intact.

The heating can be done in standard annealing furnaces or by blow torch. For that reason Metalkote can be applied on structures in place, providing a method of protection at small cost.

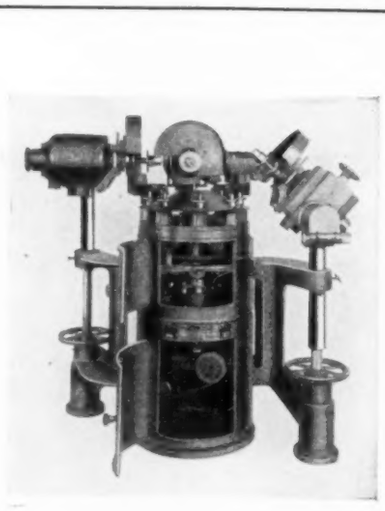
It is stated that Metalkote, after the proper treatment, provides a truly metallic surface free of organic matter; that the surface does not crack, check, strip, curl or peel; that it dries in 10 minutes and is sanitary and odorless when dry. No priming coat is necessary and one surfacing is sufficient for most purposes, although additional surfaces can be put on for special situations. It can be applied on parts that are as warm as 200 deg. F.

This type of coating is essentially industrial in character, intended for protection against corrosion, weathering, etc., but it has at the same time a pleasing, fine grained appearance.

Automatic Rotary Polisher and Buffer

Hammond Machinery Builders, Inc., Kalamazoo, Mich., will exhibit at the convention of the American Electro-Platers' Society in Cleveland, June 1-4, in Booths 20 and 21, a new automatic rotary polishing and buffing machine. The machine is designed for small parts, up to 5" in diameter and for production ranging up to 1800 pieces per hour. It is recommended for die castings, gears, light brass parts and other circular work. It has three polishing or buffing heads, each equipped with 1½ to 3 H.P. motor operating at 1750 or 3450 R.P.M. The work table is 21" in diameter with 8 work spindles driven by a ½ H.P. motor in the base at 1750 or 3450 R.P.M. Wheels up to 12" can be used and set in varying positions from horizontal to vertical.

It is claimed that this machine has a wider scope of operation and greater average hourly output than any other in its price range.



Automatic Rotary Polisher and Buffer

New Catalogs

Thor Model 7 Spray Gun. Binks Manufacturing Company, 3114 Carroll Avenue, Chicago, Ill.

Instruments from the Executive Viewpoint. "Surplus funds, invested in your plant, pay surer and quicker dividends." The Brown Instrument Company, Wayne and Roberts Avenues, Philadelphia, Pa.

Modernization—The Trend in Industry. Brown Potentiometer Pyrometers. The Brown Instrument Company, Wayne and Roberts Avenues, Philadelphia, Pa.

Oil Circuit Breakers. Catalog 6, Section 2; also Catalog 6, Section 4. Roller-Smith Company, 233 Broadway, New York.

More Facts on Technology and Employment. A sequel to Ten Facts on Technology and Employment, and further statistical proof of machinery's contribution to employment and a higher standard of living. Machinery and Allied Products Institute, 221 N. La Salle Street, Chicago, Ill.

Chemical Specialties Information Service. Foster D. Snell, Inc., 305 Washington Street, Brooklyn, N. Y.

Portable Cable; tellurium, all-rubber, Glyptal compound, loom-sheath and braided types. General Electric Company, Schenectady, N. Y.

Nickel Alloy Gear Materials and Their Heat Treatments, by J. W. Sands and F. J. Walls. By the addition of nickel to cast iron, steel or bronze, the material is better able to resist the complex strains, stresses and shocks inherent in gear drives. International Nickel Company, Inc., 67 Wall Street, New York.

Combustion Recorders. Catalog RA-346. The Hays Corporation, Michigan City, Ind.

Hydraulic Press Magazine. Hydraulic Press Mfg. Company, Mount Gilead, Ohio.

Industry Again Faces Regimentation. No. 16 in a series of booklet-editorials by Allen W. Rucker and N. W. Pickering. Farrel-Birmingham Company, Inc., Ansonia, Conn.

Thwing Paper Test. A new house organ giving interesting facts on paper testing. Thwing Instrument Company, Lancaster Avenue below 34th Street, Philadelphia, Pa.

Chicago Grinding Wheels. Descriptions, illustrations and list prices. Chicago Wheel and Manufacturing Company, 1101 W. Monroe Street, Chicago, Ill.

A Keen Tool. Stanley Fibre Board Knife No. 199. Stanley Company, New Britain, Conn.

Thermometers. Catalog No. 1250. Bristol Company, Waterbury, Conn.

Oxwelding Brass and Bronze; illustrated. A booklet on oxy-acetylene welding. The first section is devoted to the technique of fusion welding for ornamental work where the welds must have the same appearance as the base metal. The second section describes the welding of commercial yellow brass pipe disclosing joint design and welding technique giving tables, etc. The Linde Air Products Company, 30 E. 42nd Street, New York.

Industrial Combustion Data. Answers to many of the questions which present themselves to industrial heating and combustion engineering in the operation of furnaces, ovens and other heat processing equipment. Free to those writing on business letter-heads giving the official title and position; to others, price $1.00 per copy. Hauck Manufacturing Company, 126-10th Street, Brooklyn, N. Y.

Lignum-Vitae Fact Flashes. Information on practical applications of Lignum Vitae. Lignum-Vitae Products Corporation, 96-100 Boyd Avenue, Jersey City, N. J.

Triad Alkali Cleaning Compounds. Economies through the use of Detroit Rex specialized cleaning service. Detroit Rex Products Company, 13005 Hillview Avenue, Detroit, Mich.

Spectrographic Outfits for Metallurgical and General Chemical Analysis. 7th edition, 1936. Adam Hilger Ltd., 98 Kings Road, Camden Road, London, England.

Quarterly Price List of R. & H. Chemicals. E. I. du Pont de Nemours & Co., Wilmington, Del.

The Welding of Aluminum. Aluminum Company of America, Pittsburgh, Pa.

The Riveting of Aluminum, Aluminum Company of America, Pittsburgh, Pa.

Pylumin, for the protection of aluminum. A method of oxidizing aluminum and also providing a base for subsequent finishes such as paint, lacquer, etc. Metal Finishing Division, Pyrene Mfg. Company, 560 Belmont Avenue, Newark, N. J.

Gears—spur, bevel, worm, etc., and motorized reducers. A new 128-page catalog. Useful technical data on gearing, S.A.E. standard heat-treatment methods, and other handy facts. The Ohio Gear Company, 1333 East 179th Street, Cleveland, Ohio.

Reliance Plating and Polished Supplies. Bulletin No. 110. Covers compositions, buffs, polishing wheels, brushes, wire wheels, chemicals, metal cleaners, sodium cyanide, chromic acid, anodes, chemical stoneware, dipping baskets, wooden solid shoes, respirators, rubber gloves, hydrometers, test sets, copper wire, burnihing materials, etc.

Magnetic Pulleys and Pulley Type Separators; also Magnetic Separators of Other Designs. Catalog No. 25. Dings Magnetic Separator Company, Milwaukee, Wisc.

Recording, Controlling and Indicating Instruments. Index. Bulletin 435. The Bristol Company, Waterbury, Conn.

Associations and Societies

American Society for Testing Materials

260 South Broad Street, Philadelphia, Pa.

A large number of technical papers and reports are scheduled for presentation during the 1936 annual meeting of the American Society for Testing Materials, to be held in Atlantic City at Chalfonte-Haddon Hall, from June 29 to July 3, inclusive. In order to provide ample time for the presentation of the papers and for discussion, some 20 sessions are being scheduled.

Monday, June 29, is being reserved for meetings of A.S.T.M. committees and the first session is scheduled for Tuesday morning. This will be featured by an address on **"Chemical Engineering and Its Relationship to the Work of A.S.T.M."** by **Dr. H. C. Parmelee,** McGraw-Hill Publishing Co. and the president's annual address to be given by H. S. Vassar.

The **1936 Edgar Marburg Lecture,** the tenth in the series, is to be presented on Wednesday afternoon by **Dr. Arthur L. Day,** Director, Geophysical Laboratory, Carnegie Institution of Washington, on the subject **"Developing American Glass"** in which work Doctor Day has taken a leading part.

X-ray Symposium

The Symposium on X-ray Crystallography and Radiography will comprise twelve papers, six on radiography and six on diffraction. Preliminary sessions were held at the 1935 meeting in Detroit, at which many technologists in this field presented material which is to be the basis of the formal symposium. The primary objects of the symposium, which is being directed by **Dr. R. F. Mehl,** Director, Metals Research Laboratory, and Head, Department of Metallurgy, Carnegie Institute of Technology, chairman of Subcommittee VI, have been stated by the committee as follows:

(a) To describe modern methods and equipment in an elementary way in

order to assist industries in the application of X-rays to their work.

(b) To prevent as many case histories of successful applications as possible.

(c) To compare the usefulness of X-ray methods with the usefulness of other methods which may be used alternatively.

(d) To include the application of radiographic and diffraction methods to both metallics and non-metallics.

In the radiography section the papers will cover such subjects as elements of radiography, foundry applications, applications to the welding art, gamma-ray radiography and its relation to X-ray radiography and the problems of specifications. The diffraction section comprises papers on equipment and methods, constitution of alloys, chemical analysis and particle-size determinations, non-metallic applications, and cold-work, recrystallization and preferred orientations. It is expected that four sessions of the meeting will be devoted to this symposium, which promises to be one of the most extensive of any that have been sponsored by the Society.

Non-Ferrous Metals

A number of papers and reports are scheduled dealing with non-ferrous metals. Technical contributions will cover the effect of iron impurities on the annealing of high brass, effect of lead additions on the endurance limit of tin-base bearing alloys, ductility testing of aluminum and aluminum alloy steel, forming properties of non-ferrous sheet metals and stress relief annealing of high-strength Monel metal plate.

Wire

A number of papers deal with copper and copper alloy wire, including papers on torsion and flexure testing of copper wire, effect of time on tensile properties of hard-drawn copper wire and impact bend testing of wire. Several interesting committee reports will complete this session.

Spectrographic Analysis

Following the successful Symposium on Spectrographic Analysis held at the 1935 annual meeting in Detroit, another session on this subject is planned to include papers dealing with determinations of small quantities of arsenic in lead, copper and their alloys; developments in the quantitative analysis of solutions; spectro-chemical analysis of nickel alloys; and determination of magnesium in aluminum alloys.

Miscellaneous

Other papers at the meeting will discuss the testing of organic finishes.

New York District Meeting

The New York District Committee of the American Society for Testing Materials held a meeting on Tuesday, April 21 at 8 P. M. in the North Ballroom of the Hotel New Yorker, New York. The meeting was addressed by **Carlton Ellis** who gave an exhibit and lantern slide talk on Synthetic Resins.

American Zinc Institute

60 E. 42nd Street, New York

The 18th annual meeting of the American Zinc Institute was held at the Hotel Statler, St. Louis, Mo., on April 20-21. A special feature of the meeting was an address by **T. M. Girdler,** President of the **Republic Steel Corporation,** on the situation in American industry and the effect of attempts by Government to rearrange our economic system.

Most of the meeting was devoted to technical problems in galvanizing practice and papers on economic aspects of the zinc industry, among which were the following:

The Zinc Market by **C. S. J. Trench,** President, C. S. Trench & Company, Inc.

Modern Research Methods by **C. E. Williams,** Director Battelle Memorial Institute.

Some Studies in Microstructure of Zinc Coatings by **W. E. Buck,** Research Metallurgist, Granite City Steel Company.

Testing for Adherence of Galvanized Coatings by **B. P. Finkbone,** Galvanizing Consultant, American Rolling Mill Company.

Inhibitors in Pickling by **P. R. Russell,** Steel Service Division, The Grasselli Chemical Company.

Alloys in the Zinc Bath by **G. A. Brayton,** Superintendent, Galvanizing Division, Newport Rolling Mill Company.

The Treatment of Sheets for Painting by **J. L. Schueler,** Superintendent, Steel and Wire Division, Continental Steel Corporation.

Sweating of Sheets in Transit and Storage by **G. C. Bartells,** Field Engineer, American Zinc Institute, Inc.

Howard I. Young was re-elected president. **J. O. Elton, C. Merrill Chapin,** and **John A. Robertson** were elected vice-presidents; **James A. Caselton** was elected treasurer, and **E. V. Gent,** secretary.

Milwaukee Branch, A. E. S.

c/o Roman C. Binder, 1515 W. Atkinson Ave., Milwaukee, Wis.

The Milwaukee Branch, American Electro-Platers' Society annual smoker was held Saturday evening, March 21st at 7:30 P. M.

This was the largest gathering that Milwaukee has ever had the pleasure of entertaining. With well over two hundred present, representation covered a large territory, from as far South as St. Louis, as far East as Detroit, as far West as Omaha, and as far North as Minneapolis.

The Milwaukee branch gave **Oliver Sizelove** of the **Frederick Gumm Company, C. Clindinn** of the **Crown Rheostat & Supply Company,** and **George B. Hogaboom** of **Hanson-Van Winkle-Munning Company** a rising vote of thanks for their excellent papers.

A delicious buffet lunch was served with refreshments that Milwaukee is not unknown for, followed by a floor show which had the approval of everyone who witnessed it.

Waste Material Dealers

Times Building, New York

The Chicago members of the National Association of Waste Material Dealers, Inc., have organized a Luncheon Club corresponding to the Luncheon Club recently organized in New York. The first function was a dinner on April 16, held at the Hotel Sherman. They will meet regularly throughout the greater part of the year, for dinner, which has been found more convenient than luncheon.

At the meeting held on April 16th **Louis Lippa** of the **Apex Smelting Co.,** and Vice-President of the Secondary Metal Institute, presided. A very interesting statement was made by **L. Muscat** of the United American Metals Corp. of Brooklyn, N. Y. All of the out of town members were invited to address the meeting. Among them were **A. Lipkowitz** of the **Atlas Metal Co.,** Cleveland, Ohio; **Dan Hill** of the **Northwestern Iron & Metal Co.,** Lincoln, Nebr.; **H. E. Jacobs** of Milwaukee, Wis.; **Jack Zeldes** of **Zeldes & Co.,** Detroit, Mich.; **Harry Fisher** of the **Harrold-Fisher Co.,** Valparaiso, Ind.

Chicago concerns represented at the dinner were the following: **American Metal Co., Ltd.; Apex Smelting Co.; George Birkenstein Corp.; S. Birkenstein & Sons, Inc.; L. S. Cohen & Co.; Columbia Metal Co.; Division Lead Co.; Federated Metals Corp.; Goldsmith Bros.; Imperial Smelting Corp.; Benj. Harris & Co.; H. Kramer & Co.; Liberty Smelting & Ref. Co.; The Loewenthal Co.; Loewenthal Metals Corp.; Samuel Mendel & Bro.; Metals Refining Co.; H. Muehlstein & Co.; Silverstein & Pinsof, Inc.; Western Metal Co.** and **H. J. Seidenberg & Co.**

The next club dinner is to be held on Thursday evening, May 21st, at the Hotel Sherman.

Philadelphia Metals Association

The annual meeting of the Philadelphia Metals Association was held on March 26. The following officers were elected: **I. W. Wilenchik,** president; **H. F. Oschell,** vice-president; **A. Perez,** treasurer; **J. E. Fitzpatrick,** secretary.

Mr. Wilenchik pointed out the need for larger membership in order to oppose, effectively, the crippling of free marketing by legislators.

Charles M. Haskins, Managing Director of N.A.W.M.D., also spoke at the meeting.

American Hot Dip Galvanizers' Association

The American Hot Dip Galvanizers' Association has been organized in Pittsburgh with the following officers:

T. M. Gregory, Hanlon-Gregory Company, Pittsburgh, president; **I. M. Herman, Acme Galvanizing Company,** Milwaukee, Wisc.; and **D. R. Pearlman, Enterprise Galvanizing Company,** Philadelphia, vice presidents; **S. J. Swensson,** secretary and treasurer.

Society of Chemical Industry

305 Washington Street, Brooklyn, New York

The American Section of the Society of Chemical Industry announces the election of the following officers to serve for the year ending June 1, 1937:

Chairman: **James G. Vail.**
Vice Chairman: **Wallace P. Cohoe.**
Hon. Secretary: **Foster Dee Snell.**
Hon. Treasurer: **J. W. H. Randall.**

Five new members were elected to the Executive Committee to take the place of retiring members. Those newly elected are **Charles N. Frey, Robert J. McKay, A. A. Backus, L. S. Kohnstamm** and **S. P. Miller.**

Copper and Brass Mill Products Association

420 Lexington Ave., New York

Effective May 1, 1936 the address of the Association will be changed from 122 E. 42nd St., New York, to 420 Lexington Avenue, New York. The telephone number will be MOhawk 4-6510.

Battery Manufacturers

7 East 44 Street, New York, N. Y.

The 1936 Spring Convention of the National Battery Manufacturers Association, Inc., will be held at the Statler Hotel in Cleveland, Ohio—Wenesday and Thursday, May 20th and 21st, 1936.

Personals

E. H. Dix, Jr.

E. H. Dix, Jr., chief metallurgist, Aluminum Research Laboratories, New Kensington, Pa., is the new chairman of the Institute of Metals Division of the A.I.M.E. He is also secretary of the American Society for Testing Materials Committee B-7 on Light Metals and Alloys, Cast and Wrought, for a term of two years.

E. H. DIX, JR.

Mr. Dix is a graduate of Cornell University, with degrees of M.E. and M.M.E. Subsequently, he was instructor in the Materials Testing Department for several years and later he became associated with the Baltimore Copper Smelting and Rolling Company, Bureau of Aircraft Production and the Lynite Laboratories of the Aluminum Castings Company. At the present time, he is in charge of the metallurgical sections at Cleveland and New Kensington.

In addition to the activities mentioned above, Mr. Dix is also a member of the following A.S.T.M. Committees: B-3 on Corrosion of Non-Ferrous Metals and Alloys, Sections on Compression Testing and Tension Testing of Committee E-1 on Methods of Testing, E-4 on Metallography and B-6 on Die Cast Metals and Alloys. He served as chairman of the special committee of B-7 which prepared the report recently issued by A.S.T.M. on "Service Characteristics of the Light Metals and Their Alloys."

Theodore E. Palmer recently was made assistant foundry superintendent of the **Gilbert-Barker Manufacturing Company,** West Springfield, Mass. **Mr. Palmer** graduated from Wentworth Institute, Boston, in 1918, and immediately entered the employ of the **Brown and Sharpe Manufacturing Company,** Providence, R. I., remaining until 1922 when he was made foundry superintendent of the **Wilcox, Crittenden Manufacturing Company,** Middletown, Conn. In 1923 he was made foundry superintendent for the **Old Colony Foundry Company,** E. Bridgewater, Mass., and remained with that organization until his recent appointment.

Albert D. Wilson, president of the **Bristol Brass Corporation,** Bristol, Conn., has been elected a director of the **Bristol Bank and Trust Company,** Bristol, to succeed the late **Alexander Harper. Mr. Wilson** succeeded Mr. Harper as president of the Bristol Company last year.

Ellsworth O. Jones has been appointed director of the recently formed Safety and Hygiene Section of the American Foundrymen's Association. For the past three years Mr. Jones has been consultant for the Industrial Relations Bureau of the National Founders' Association. He is known widely through his work with national and state organizations in the study of industrial dust problems, with which his work with A.F.A. will largely deal.

Adolph F. Schoepflin is now works manager of the **Doehler Die Casting Company,** Batavia, N. Y. Mr. Schoepflin was previously plant superintendent of the company's Batavia plant.

Andrew E. Buchanan has accepted the position of research director of the **Remington Arms Company.** His headquarters will be at Bridgeport, Conn. Mr. Buchanan after graduating from the chemical engineering department of Lehigh University was employed by the E. I. duPont de Nemours & Company. In 1922 he joined the editorial staff of Chemical and Metallurgical Engineering. For the past eight years he has served as secretary of the Alumni Association of his alma mater.

John E. Giles, 225 McHenry Avenue, Woodstock, Ill., has been named superintendent of the **Alemite Die Casting and Manufacturing Company** plant in above city. He succeeds **E. W. Peterson,** resigned. Mr. Giles has been connected with the Alemite company, for the past seven years most of the time in the capacity of sales manager. **Fred Drummond,** who has been connected with the Alemite plant for some twenty years, was promoted to position of vice-president and general manager to succeed **D. F. Fessler** who resigned. The present Alemite officers are: **Royce G. Martin,** president; **Fred H. Drummond,** vice-president and general manager; **Walter V. Flood,** treasurer and controller and **F. H. Landwehr,** secretary. All except Mr. Drummond are located at the Toledo office of the company.

Haig Solakian, for the past seven years chief metallurgist for **Geometric Tool Company,** New Haven, Conn., has been appointed research metallurgist for the **A. F. Holden Company,** New Haven. He received his training and his doctor of science degree from Massachusetts Institute of Technology and has been identified with the Bethlehem Steel Company, Remington Typewriter Company and the United States Mining and Refining Company, also the United States Bureau of Standards.

N. W. Pickering, President, Farrel-Birmingham Company, Inc., Ansonia, Conn., was elected first Vice-President of the National Metal Trades Association, at its annual meeting in New York in April.

George A. Seyler of the Lunkenheimer Company, Cincinnati, Ohio, was elected a councilor of the National Metal Trades Association at its recent meeting in New York in April.

L. A. Dall has been elected a vice president of the **Aluminum Industries,**

Inc., with headquarters at Cincinnati, Ohio. He became associated with Aluminum Industries, Inc., when the Dall Manufacturing Company, Cleveland, was consolidated with the local concern last November. The Dall organization continues to operate as a separate unit.

Walter H. Diemer has succeeded his brother **William L. Diemer,** resigned, as president of the **American National Company,** Toledo. The company has five plants in the city manufacturing juvenile vehicles and metal wheels.

George Lord has taken a position with **Foster D. Snell, Inc.,** 305 Washington Street, Brooklyn, N. Y.

Frances Parry, Adelphi '30, is now with **Foster D. Snell, Inc.,** 305 Washington Street, Brooklyn, N. Y.

Dr. Foster Dee Snell of **Foster D. Snell, Inc.,** 305 Washington Street, Brooklyn, N. Y., addressed the National Executive Housekeepers' Association on March 12, 1936 at the Hahnemann Hospital, Philadelphia. His subject was "Cleaning Materials."

Charles H. Proctor, Founder of the American Electro-Platers' Society has purchased a home at 309 Vine Avenue, Clearwater, Fla. He will call his new home Twin Palms, and will spend a large part of each year there. Mr. Proctor reports that a very interesting story can be told about the detrimental influence of the humid climate of southern Florida upon electroplated products.

G. V. Pollard has been appointed General Works Manager in charge of **Kelvinator Corporation** manufacturing operations at Detroit and Grand Rapids, it was announced by **G. W. Mason,** President and Chairman of the Board. **Mr. Pollard** has been Director of Quality for Kelvinator since November 1, 1928, in which capacity he was in constant touch with all phases of the manufacturing and production of Kelvinator products and their rigid inspection before release to consumers.

Charles A. Chayne, former assistant chief engineer, has been appointed to the post of chief engineer of the Buick Motor Company, Flint, Mich. Mr. Chayne will succeed **F. A. Bower** who has been granted an indefinite leave of absence because of ill health.

Dr. L. E. Mustard has been appointed district manager of The Bristol Company (Waterbury, Conn.) branch office in Detroit.

Obituaries

Purcel O. Seiser

Purcel O. Seiser, 44, Fairfield, Conn., superintendent of the United States Aluminum Company's plant, there, passed away on February 16. Mr. Seiser was superintendent of the company's plant at Cleveland, for two years before going to Fairfield.

Joseph D. Sargent

Joseph D. Sargent, long identified with Sargent and Company, and son of that company's founder, died on April 9, at Hurley, N. Y., after a long illness. Mr. Sargent was graduated from Yale in 1889 and immediately entered his father's business. He retired in 1928.

Henry P. Biegel

Henry P. Biegel, 69, superintendent of No. 1 foundry at West Allis Works of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., since 1904, died March 29 at Deaconess Hospital of appendicitis.

HENRY P. BIEGEL

Mr. Biegel learned his trade at Filer and Stowell Company, Milwaukee, and was employed for a time by E. P. Allis and Company in 1888. After gaining experience in various Wisconsin and Pacific Coast foundries, he came back to Allis South Foundry in 1895. Since that time he has been continuously employed by Allis-Chalmers, a period of 41 years. An assistant foreman, he was sent in 1900 to supervise blowing engine work being done at a leased plant operated by the Allis Company in Buffalo, N. Y., later returning as foreman in Reliance Works Foundry. In 1904 he became a foreman at West Allis Works and since 1906 has been superintendent of No. 1 Foundry.

Considered one of the best and ablest foundrymen in the United States, Mr. Biegel was also prominent in public affairs of West Allis, being on the fire and police commission for 20 years prior to 1932, and president of the commission for two terms.

Surviving are his wife, Antoinette; four daughters, Elizabeth, Catherine, Mrs. R. J. Patterson of West Allis, and Mrs. Genevieve Morris of Milwaukee, and a son, Raymond Biegel of West Allis.

Henry Arthur Vogelsang

Henry Arthur Vogelsang, a former superintendent of the Waterbury Button Co., died in Warsaw, N. Y., from pneumonia April 1. His father, Arthur Vogelsang, was a button manufacturer of Kitchener, Ont. He came to the Waterbury plant in 1904 and served as superintendent 16 years, leaving in 1922 to become manager of Northern Buttons Ltd., at Smith's Falls, Ont., afterwards being manager of the Warsaw Button Co. of Warsaw, N. Y. The funeral was held in London, Ont., April 4, and burial was there. His widow, the former Alice Mae Berg of Waterbury, Conn., two sons, Arthur and Robert Ellis, two sisters, Alfred E. Voelker and Edith Vogelsang, all of Ontario, surive.—**W. R. B.**

Metal Developments

Tantalum is now being used in connection with the "leak-proof" fountain pens, according to a leaflet from the **Fansteel Metallurgical Corporation,** North Chicago, Ill. The leak-proof "secret" is the safety ink shut-off, an ingenious device made of tantalum.

The **Federal Trade Commission** has ordered eleven manufacturers of zinc and copper plates for photo engravings, to discontinue agreements entered into to fix, maintain and enforce uniform price for those products.

The recently placed embargo on **scrap tin** has reduced severely the sales of this material to Japan according to a report from Philadelphia and Reading metal exporters.

Nickel statistics make fascinating reading. A recent release of the **International Nickel Company** shows sales of their nickel rose from 74,356,969 pounds in 1933 to 129,850,307 pounds in 1935; nickel silver and nickel copper alloys from about 13,500,000 to 15,600,000 lbs.; pure rolled nickel decreased from 12,750,000 to 10,400,000; nickel for plating rose from 7,500,000 to 13,000,000; Monel metal 6,750,000 to 10,400,000; heat resistant and electrical alloys, 2,200,000 to 6,500,000; miscellaneous uses (magnetic alloys, nickel brasses, nickel bronzes, nickel aluminum alloys and white gold) 3,000,000 to 7,800,000. Very few products, metal or otherwise, have such a record.

The **Welding Research Committee** of the Engineering Foundation has laid plans to expand its organization for the advancement of welding research according to **Professor C. A. Adams** of Harvard University, Chairman. Under the direction of **Col. C. F. Jenks,** Commanding Officer of the Watertown, Mass., Arsenal, a new industrial subcommittee to coordinate industrial welding research in the United States, has been formed. Already 60 investigations

have been reported under way in universities alone, and many more researches are going forward in industrial and government laboratories.

The **Mellon Institute of Industrial Research,** Pittsburgh, Pa., has issued an interesting 23rd annual report of their activities during 1935-36. Noteworthy among their projects are the following: a research on the extension of the metal bonding process to the manufacture of protected galvanized iron and steel culverts; studies on heat insulation with special reference to air conditioning in manufacturing plants and other structures; an abrasive fellowship for the development of a series of novel refractories; a bright annealing process for steel wire including a coating for protection against rust; research on urban air pollution which will be helpful in the further study of silicosis.

The **Monarch Machine Tool Company,** Sidney, Ohio, is putting out an interesting metal plate affixed to its machines which includes the figure **"Cost Installed"** for the machine to facilitate keeping of cost records. It seems to have resulted also in better work by the men since they know the actual cost of the machines entrusted to them.

Aluminum foil linings are said to be the means of bringing back into use, the old-fashioned paper bag which was being displaced by metallic containers.

The **State of Connecticut** has adopted permanent **aluminum** license plates starting **March 1, 1937** for automobile owners, who will keep the same numbers indefinitely. A considerable saving in clerical work will result.

The great 200-inch lens made by the **Corning Glass Works** for the giant telescope on Mt. Wilson will, when properly polished and repaired, receive a deposit of a thin film of **aluminum.** The process, which was developed by Edison many years ago, consists of vaporizing aluminum in a vacuum chamber in which the glass disc is placed. Bits of aluminum will hang on coils of tungsten wire within the chamber. A current is turned on which heats the tungsten white hot. The aluminum on the coils boils off forming a sort of "steam" which moves to the cold glass disc, only a few inches away, and the metal is deposited as a sort of "dew" about one 250,000th of an inch thick.

An interesting installation of **bronze rolling grilles** is reported by the **Cornell Iron Works, Inc.,** 3600-13th Street, Long Island City, N. Y. The grille is composed of 5/16" round horizontal polished bronze crimped rods connected by vertical links of polished cast bronze. The entire grille is finished in statuary bronze color to match the bronze revolving door behind it. The grille is retained in bronze, channel-shaped, vertical side guides at each jamb and locks in securely against any possible pulling out or forcing. It is said to work with the ease and convenience of a window shade, rolling up around the pipe shaft and out of sight when opened. This installation, said to be the first bronze rolling grille ever made in America, and so far as the manufacturers can ascertain, the first in the world, was installed at Luchow's Restaurant, 110 E. 14th Street, New York City.

New developments in the hard facing of valves for vital units of power systems, gas welding and cutting and acetylene generators featured the exhibits of **Union Carbide and Carbon Corporation** and its allied firms, **Linde Air Products Company** and **Haynes Stellite Company,** 30 E. 42nd Street, New York at the Power and Engineering Exposition, held in Chicago, April 20-24.

Metal manufacturing companies and metal working machinery companies are concentrating with the utmost seriousness on the problem of developing practical prefabricated homes. **Copper, aluminum,** and of course, steel and their alloys are being used widely in this experimental work. Some of the companies who are pioneering are: **Hobart Brothers,** Troy, Ohio; **Harnischfeger Corporation,** Milwaukee, Wisc.; **General Electric Company,** Schenectady, N. Y.; **Reynolds Metal Company,** New York; **Kennecott Copper Company,** New York.

Corporation Earnings

Net Profit Unless Followed by (L) Which is Loss

	1935	1934
Advance Aluminum Castings Corporation	$71,250	$11,404 (L)
Aluminum Company of America	283,554	216,266 (1935)
Anaconda Wire and Cable Company (First Quarter—1936)	9,571,206	6,466,149
Art Metal Works Inc.	308,886	200,938
Bohn Aluminum and Brass Corporation (First Quarter—1936)	194,343	195,408 (1935)
Bridgeport Brass Company (First Quarter—1936)	335,129	554,614 (1935)
Doehler Die Casting Company (First Quarter—1936)	13,391,299	9,372,733 (1935)
E. I. duPont de Nemours & Company (First Quarter—1936)	209,622	172,721 (1935)
Federal Mogul Corporation (First Quarter—1936)	61,992	33,132 (1935)
General Alloys Company	23,270	20,506
General Cable Corporation (First Quarter—1936)	115,785	126,318 (L-1935)
General Refractories Company (First Quarter—1936)	230,583	198,802 (1935)
Gorham Manufacturing Company	160,428	214,292
Hajoca Corporation	395	199,181 (L)
International Bronze Powders, Ltd.	351,219	305,896
International Silver Co. (First Quarter—1936)	169,728 (L)	341,477 (L-1935)
McCord Radiator & Mfg. Company (First Quarter—1936)	123,121	42,893 (1935)
Pacific Tin Corporation	402,169	458,567
Parker Rust Proof Company (First Quarter—1936)	250,393	273,850 (1935)
Revere Copper & Brass, Inc. (First Quarter—1936)	234,769	390,242 (1935)
Savage Arms Corporation (First Quarter—1936)	53,968 (L)	66,930 (L-1935)
Segal Lock & Hardware Co.	3,526	9,635 (L)
Yale & Towne Mfg. Company (First Quarter—1936)	170,903	9,676 (L-1935)

Novel Exhibit for Foundrymen's Show

A novel treatment in exhibit background construction will be employed by **The International Nickel Company, Inc.,** 67 Wall Street, New York, in their booth at the coming Foundry and Allied Industries Exposition in Detroit. The treatment adopted will make use of a background composed almost entirely of

Booth of the International Nickel Company Constructed by Jenter Exhibits, Inc., for the Foundry & Allied Industries Exposition Held in Detroit, Michigan, from May 5 to 9, 1936

sheets of electrolytic nickel, the basic product used in the production of ferrous and non-ferrous nickel alloys. Electrolytic nickel is the purest form of nickel commercially available. A typical analysis puts the nickel content at 99.95%.

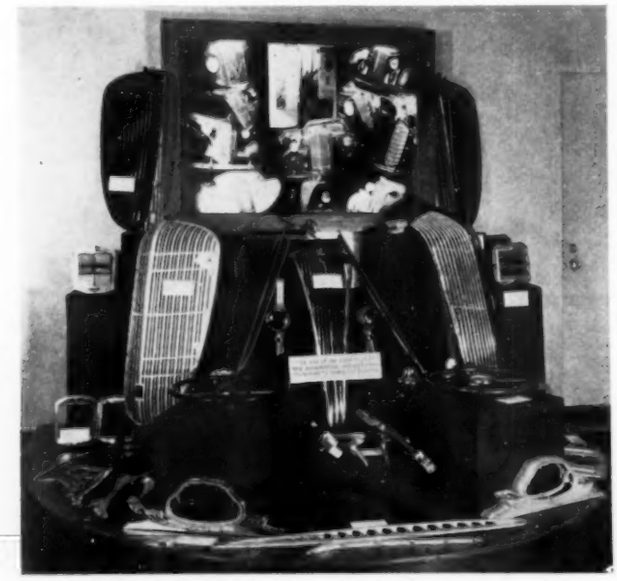
The background will contain eight illuminated windows in which important classifications of cast nickel alloys will be shown. The windows devoted to the nickel cast irons will include the special purpose alloys—"Ni-Resist" and "Ni-Hard"; those in the non-ferrous group will include castings of nickel silver, nickel bronze and nickel aluminum; nickel steel and heat and corrosion resistant castings will also be shown.

An item of popular interest which will be displayed among many others is a silver plated clarinet manufactured by the **C. G. Conn Band Instrument Company**, Elkhart, Ind., with keys and levers cast of 20% solid nickel silver. The advantage of this type of construction, of course, is that in spite of constant handling of these parts which in time will wear off the plating, a silvery white metal will always be showing.

A conference space will be provided at one end of the booth for discussion between the technical staff in attendance and those visitors who desire information on the production or application of cast nickel alloys.

Exhibit of Die Castings

Providing a visual demonstration of the great diversity and many special advantages of die castings, the most comprehensive exhibit of die-cast products ever held has been installed under the sponsorship of the **American Die Casting Institute** at **Metal Products Exhibits**—the permanent exhibition of metals, alloys, plastics, and finishes—located in the International Building, Rockefeller Center, New York. The display is free to the public and is open for inspection from 10 A. M. to 6 P. M. every weekday until its close in May.



The Use of Die Castings in the Automobile Industry Has Increased by Leaps and Bounds

The die-cast products on display, which were contributed by 25 producers, include: automobile fittings, trim, hardware, and equipment parts; parts of industrial, business, vending, and domestic machines; tools, clocks, locks, household appliances, toys, novelties and other items. The great majority of the exhibits are made from zinc alloys, but examples of the use of alloys in which aluminum, magnesium, and other metals predominate are also shown.

Many of the exhibits are of extreme intracacy and illustrate how such parts simplify assembly and can be produced by die casting with great accuracy and rigid tolerances without machining. Other exhibits emphasize the growing tendency to use die casting for relatively large parts, such as automobile radiator grills, instrument panels, and windshield frames, thereby securing refinement of detail with economical mass production.

Another group shows the applicability of die casting to the production of the odd contours required by streamlining.

At the other extreme, is an interesting collection of 10-cent store toy automobiles and airplanes which delight not only youngsters but also grown-ups with their realistic designs.

Attractive finish is now universally recognized as an essential factor in the selling of many kinds of consumers' goods, and the capabilities of die casting in this direction are demonstrated by clocks, washing machines, ironing machines, kitchen equipment, office devices, retail store machines, etc., made up largely of plated or lacquered die-cast parts.

Advance Pressure Castings, Inc.
34-48 N. 15th St.
Brooklyn, N. Y.

Alemite Die Casting & Mfg. Co.
Woodstock, Illinois

Aluminum Co. of America
Garwood, New Jersey

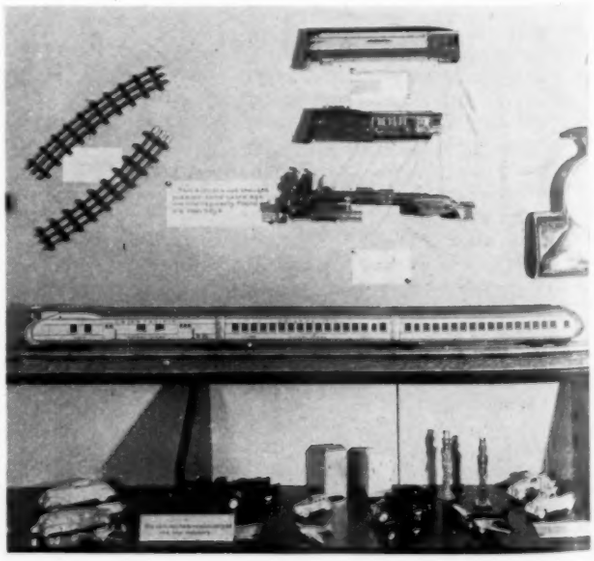
Badger Die Casting Co.
1570 S. 1st St.
Milwaukee, Wisconsin

Benton Harbor Malleable Industries
Benton Harbor, Michigan

The Cleveland Hardware & Forging
3270 E. 79th St.
Cleveland, Ohio

DeCardy Bros. Company
1806-8 N. Keeler Ave.
Chicago, Illinois

Dollin Corporation
600 S. 21st Street
Irvington, N. J.



Die Castings Have Revolutionized the Toy Industry

C. M. Grey Mfg. Co.
East Orange, N. J.

The Hoover Company
North Canton, Ohio

Latrobe Die & Casting Co.
Latrobe, Pennsylvania.

Mt. Vernon Die Casting Corp.
Mt. Vernon, N. Y.

New Products Corp.
P. O. Box 666
Benton Harbor, Michigan

Paragon Die Casting Co.
2701-2709 N. Crawford Ave.
Chicago, Ill.

Parker White Metal & Mach. Co.
Erie, Pennsylvania

Phoenix Die Casting Co.
21 Illinois St., Buffalo, N. Y.

Precision Castings Co., Inc.
Syracuse, N. Y.

Pressure Castings, Inc.
Cleveland, Ohio

Rupert Diecasting & Stamping Corp.
1655 Cleveland Ave.
Kansas City, Missouri

Schultz Die Casting Co.
1810 Clinton St., Toledo, Ohio

Sterling Die Casting Co., Inc.
743-39th St., Brooklyn, N. Y.

The Stewart Die Casting Corp.
4535 Fullerton Ave.
Chicago, Illinois

Stroh Die Moulded Casting Co.
525 East Michigan Street
Milwaukee, Wisconsin

The Superior Die Casting Co.
875 E. 70th St., Cleveland, Ohio

Twin City Die Casting Co.
Talmage & 33rd Ave.
Minneapolis, Minnesota

Business Items-Verified

B. Preiser Company, Washington Street, W., Charlestown, W. Va., industrial chemicals, has plans for new two-story plant, 40 x 180 ft., primarily for storage and distribution. Cost about $30,000 with equipment. This firm operates the following departments: lacquering and japanning.

The **Houde Engineering Corporation,** a division of the Houdaille-Hershey Corporation, Detroit, Mich., has purchased from the Kelch Heater Company, Detroit, the entire business and assets of its hot air automobile heater department. Manufacturing equipment of this department has been moved to the Houde plant at Buffalo where the heater will be manufactured in the future. This firm operates the following departments: tool room, spinning, stamping, brazing, plating, polishing, grinding room and japanning.

Huntington Stove and Foundry Company, 20th Street and First Avenue, Huntington, W. Va., is looking for a good used oblique nickel plating barrel, 22½" top, 20" depth, 20" bottom, direct motor-driven, and an oblique steel drum tumbling barrel, medium size motor-driven.

The Krect-Shave Razor Company, 3005 N. E. Sandy Blvd., Portland, Ore., is contemplating the installation of a complete nickel plating unit. Only a small unit will be required to start, but it will be so designed as to permit additional units as expansion becomes necessary.

Thomas Turner of the **Turner Foundry & Machine Co.** died last December. His brother, **William Turner,** who was connected with the Turner Foundry & Machine Co. has started the **Turner Machine Co.** at 921 Tioga St., Philadelphia, Pa.

Hajoca Company, Walnut and 31st Streets, Philadelphia, Pa., manufacturer of plumbing equipment and supplies, has leased two-story building at Miller and King Streets, Newark, N. J., about 24,000 sq. ft. floor space for new branch and display rooms. Present branch at 120 Frelinghuysen Avenue, Newark, will be removed to new location. The firm operates the following departments: brass, bronze foundry; brass machine shop, tool room, casting shop, plating, and polishing.

Reynolds Metals Company, Inc., 19 Rector Street, New York, manufacturer of metal foils and kindred specialties, with main works at Louisville, has acquired property and buildings of Lucey Mfg. Corporation, Chattanooga, Tenn., manufacturers of boilers, plate products, etc. now in liquidation. Definite plans for the reconditioning and use of this plant have not been completed but will be announced later.

Federated Metals Corporation, 120 Broadway, New York, announces that **Joseph F. Sweeney** has been engaged to specialize in the purchase of scrap nickel, nickel alloys and nickel bearing material. Mr. Sweeney was formerly connected with International Nickel Company, Allegheny Steel Company, Michiana Products Corporation, H. Baker and Company and Cosmo Metal Alloys Corporation.

Warren Telechron Company, Ashland, Mass., manufacturer of electric clocks and clock mechanisms, parts, etc., has acquired former local plant of General Chemical and Solvents, comprising about two acres and building of about 10,000 sq. ft. floor space, and will remodel this plant intending to use it in the fabrication of punch press parts and the production of coils used in their clocks.

Indianapolis Brass and Aluminum Foundry, 1410 W. Morris Street, Indianapolis, Ind., was recently damaged by fire, estimated to be at least $6,000. Many of the foundry's 7,000 patterns used in auto parts manufacture were destructed. This firm operates the following departments: brass, bronze and aluminum foundry, and is interested in disc sanders, oil burner core ovens and molding sand.

U. S. Reduction Company, East Chicago, Ind., announces an addition to plant, where the latest and most modern laboratory equipment will be installed to take care of the constantly growing demands for scientific research and development in the aluminum industry.

The Egyptian Lacquer Manufacturing Company, for many years located at 90 West Street, New York, announce the removal of their offices to Rockefeller Center. They are now located on the 29th floor of the R. K. O. Building (1270 Sixth Avenue) directly adjacent to the Radio City Music Hall, appropriately called "the show place of a nation."

Allied Store Utilities Company, 2401 N. Leffingwell Avenue, manufacturers of Hussmann-Ligonier Refrigerators are putting up a new 2-story building.

The Glyco Products Co., Inc., New York, announce that on and after April 25th, their new address will be 148 Lafayette St., (near Canal St.), New York, N. Y., Telephone No. CAnal 6-6510. This move has been made in order to consolidate the laboratories, warehouse and executive offices.

The Roller-Smith Company, 233 Broadway, New York, N. Y., announce the following items of interest in connection with their sales agencies:—on April 1st **George W. Burnes,** 259 Delaware Avenue, Buffalo, N. Y., became the Roller-Smith Company's Sales Agent for the Buffalo territory. Mr. Burnes has for nearly twenty years been engaged in the sale of products similar to those of the Roller-Smith Company in the Buffalo territory. On April 1st **J. J. Cassidy,** 72 Jacob Street, Malden, Massachusetts, became the Roller-Smith Company's Sales Agent for the New England territory. Mr. Cassidy is well known in the New England territory, having been identified with the sale of electrical apparatus in that territory for many years. On April 1st **Goodyear and Hammersley Incorporated,** 120 Greenwich Street, New York, N. Y., became a Special Sales Agent of the Roller-Smith Company.

Pfaltz & Bauer, Inc., who have been at 300 Pearl Street, New York, for the past 36 years, have found it necessary to acquire additional news quarters on the thirtieth floor of the Empire State Building, in order to provide adequate facilities for many new activities. They have recently added many new lines of instruments such as analytical balances, microscopes, photoelectric apparatus and other types of laboratory equipment. The general offices and showrooms will

be in the Empire State Building, and the downtown warehouses at 300 Pearl Street and 12 Peck Slip.

Munning & Munning, Inc., manufacturers of electroplating and polishing equipment and supplies, 202-208 Emmett St., Newark, N. J., announce the removal of their New York office to 11 West 42nd Street, New York City.

Harrison & Company, Haverhill, Mass., manufacturers of buffing and polishing compounds were, during the recent floods, under water to a depth of 14 feet. The plant has now been cleaned and disinfected, and all the spoiled stock replaced by new materials. They are now ready to take care of orders promptly.

Federated Metals Corporation, 2425 Hunter Street, Los Angeles, is erecting two new plant units, about 43,000 sq. ft. of floor space, one for warehousing manufactured non-ferrous metals and the other for handling, storing, sorting, etc., scrap non-ferrous metals.

The Schulte Grinding and Polishing Machine Company, designers and builders of automatic electric controlled sheet grinding, polishing and buffing machines, have moved their office from 6400 Breakwater Avenue to 3300 Riverside Avenue, S. W., Cleveland, Ohio. **Louis Schulte,** an old pioneer in this line, is again in full control and charge of the company.

Any manufacturer interested in quality industrial coatings is invited to inspect the permanent exhibit of **The Stanley Chemical Company** of East Berlin, Conn. at the **Metal Products Exhibits, Inc.,** Rockefeller Center, New York City. In this exhibit which has been arranged by a prominent New York designer will be found products of a few of the manufacturers using Stanley coatings. These articles in the metal, wood, rubber, cloth and paper industries reflect some of the wide range of specialized coatings which are available to manufacturers in these industries.

The **Cleveland Buff & Mfg. Co.,** Cleveland, Ohio, has been licensed by the **J. J. Siefen Company,** 1936 W. Lafayette Blvd., Detroit, Mich., to manufacture and sell the Economy Buff Sectors, under the patent of the latter company. The Cleveland Company will start immediately to serve their trade with the Economy Buff, made up of customers' used or discarded buffs.

News From Metal Industry Correspondents

New England States

Waterbury, Conn.

April 27, 1936.

Officers and directors of the **Scovill Mfg. Co.** were reelected April 20 as follows: President and general manager, **Edward O. Goss;** vice president and general superintendent, **John H. Goss;** vice presidents, **Chauncey P. Goss, George A. Goss, Bennet Bronson, William M. Goss, W. T. Hunter, Fred Trisman, T. B. Myers;** secretary, **Francis T. Reeves;** treasurer, **Leavenworth P. Sperry;** assistant secretaries, **C. F. Doherty, Burdon P. Hyde, A. R. DeBrauwere, N. Q. Bangs;** assistant treasurers, **John V. Montague** and **Fred Trisman;** directors, **E. O. Goss, J. H. Goss, G. A. Goss, C. P. Goss, W. M. Goss, L. P. Sperry, Bennet Bronson, Roger S. Sperry, John P. Elton, William S. Fulton, W. T. Hunter, S. T. Ward, Austin Adams, H. Lamson Scovill.**

The annual report of the company showed a net profit for 1935 of $1,057,285, an increase of over $300,000 over the first year, and the first time in five years that the earnings equalled the dividend payments. Total assets are set at $39,988,000, a gain of $1,400,000 over a year ago.

The shipments of manufactured products of the **American Brass Co.** and of the **Anaconda Wire & Cable Co.** in 1935, totalled 531,102,747 pounds, an increase of 106,000,000 pounds over 1934, according to the annual report of the parent company, the **Anaconda Copper Co.**

A falling off of employment in March as compared with February but an increase as compared with March, 1935 is recorded by the Chamber of Commerce statistics. Employment in March this year was 126 less than in February but 3,035 more than in March, 1935, in all the factories of the city. In the eight largest factories, 167 less persons were employed in March than in February this year but 2,000 more than in March, 1935. Bank clearings were $347,400 greater in March than in February this year and $1,077,100 greater than in March, 1935. Bank debits were $2,654,017 greater in March than in February this year and $1,861,523 greater than in March, 1935. Employment in all factories totalled 31,899 for March this year and totalled 17,043 in the eight largest factories.

The **American Brass Co.** is planning the erection of a steel factory building, 70 by 240 feet, one-story high. They will have an exhibit at the **Inform-a-Show** of the **National Association of Purchasing Agents** at New Orleans, May 25 to 28. It will exhibit all forms of copper and copper alloys, including sheet, rod, wire, tube, extruded and drawn shapes, die pressed parts and pressure die castings.

The **Waterbury Farrel Foundry & Machine Co.** paid the regularly quarterly dividend of 25 cents a share on April 1.

The **Lux Clock Mfg. Co.** has had plans drawn for a three-story factory building 140 by 43 feet and an addition to an existing building, 40 by 160 feet.

George F. Bauer, export manager of the **Automobile Manufacturers Association,** speaking at the Chamber of Commerce luncheon here last month attended by local manufacturers, said the reciprocal trade policy has helped local industries. He said many of Waterbury's exports are "invisible," mentioning that many concerns supply automobile concerns in Detroit and elsewhere with essential products which are shipped abroad as part of the completed automobile, such as bolts, finishings, push buttons, gas tank caps, hub caps, radiator caps, handles, castings, tubings and forgings. The reciprocal tariff agreement, he said, had resulted in an increase in export of automobiles, typewriters, refrigerators, radios, and sewing machines. Connecticut, he said, shared in all of this increase, either in export of the completed article or in the manufacture of various parts.—**W. R. B.**

Connecticut Notes

April 27, 1936.

HARTFORD—Cornelius F. Kelley, president of the **Anaconda Copper Mining Co.,** will be the chief speaker at the annual convention of the **Connecticut Chamber of Commerce** here May 26.

Due largely to the flood, man hours in the factories of this county decreased 13.1 per cent in March, the amount of wages lost being $525,000. The number of employees in 43 Hartford plants increased by 41, to a total of 25,443.

The **War Department** has ordered 200 new aircraft engines, costing $1,877,030 from the **Pratt & Whitney Aircraft Co.** here.

NEW BRITAIN—Leavenworth P. Sperry, treasurer of the **Scovill Mfg. Co.** of Waterbury, was added to the directors at the annual meeting of the **American Hardware Corp.** here last month. Other directors and officers were reelected, including Pres. **George T. Kimball.** The latter reports an operating profit of $165,400 for 1935 before depreciation. Gross sales were 25 per cent better than the previous year. The directors declared three quarterly dividends of 25 cents each for the rest of the present year.

Stockholders of the **Stanley Works** reelected the former officers and directors, last month, headed by Pres. C. F. **Bennett,** and including vice presidents, **J. E. Cooper, E. W. Christ, M. A. Coe, Walter H. Hart, M. H. Pease, E. W Pelton, R. E. Pritchard, J. E. Stone;** secretary, **E. W. Christ;** treasurer, **Louis W. Young,** assistant secretary, **Patrick F. King;** assistant treasurer, **Walter C. Milkey.** It was voted to reduce the

dividend rate on preferred stock from 6 to 5 per cent.

The **North & Judd Mfg. Co.** paid the regular quarterly dividend of 25 cents on April 1.

All directors and officers of the **New Britain Machine Co.,** headed by President **H. H. Pease,** were reelected last month. The **New Britain Gridley Machine Co.** also reelected its directors and officers, headed by President **H. H. Pease.** Neither company declared a dividend.

Employees in the principal factories of the city decreased 82 in March to 13,957 and the loss in man hours was 29,167 to 2,218,687.

MERIDEN — Stockholders of the **International Silver Co.** added **Morgan J. Calahan, Jr.,** of New York to the board of directors last month. Other directors and officers were reelected. The company has established the **International Silver Sales Institute** under the direction of **Frank N. Wilcox** in one of the local buildings where there is a display of the productions of 22 factories and departments. The silverware is set up in surroundings such as it will be used in and all the rooms are furnished and decorated in the modernistic manner.

THOMASTON—The **General Time Instrument Co.,** of which the **Seth Thomas Clock Co.** here is a subsidiary, has purchased the **Stromberg Electric Co.** of Chicago and is moving the business here. As a result the local working force will be increased from 370 to over 500 soon. Parts of the local plant are being changed to accommodate the machinery to be moved here from Chicago. The **Stromberg Co.** manufactures payroll time computing devices. The parent company plans to increase the number of shares of stock by 75,436 to 326,889. Stockholders may subscribe for one new share for every three held at $23.50 per share.

BRISTOL — Employees in the 12 largest plants of this city increased 27 in number in March to 10,377 but man hours decreased 10,012 to 1,636,617.

The **Wallace Barnes Co.** has drawn plans for an addition to its rolling mill.

SOUTHINGTON—Employees in the 6 principal plants here decreased 14 during March to 1,476 and man hours decreased 403 to 196,771.

NEW LONDON—The **Electric Boat Co.** had a net earnings of $434,264 in 1935 or 58 cents a share compared with $339,948 the previous year. Current assets amount to $3,640,336 and current liabilities to $531,108. Total assets are $7,328,680 and earned surplus is $3,901 compared with $3,471 a year ago.

—W. R. B.

Middle Atlantic States

Newark, N. J.

April 27, 1936.

Israel Spicer and **Jacob S. Glickenhaus** have been appointed by **Federal Judge Fake** as temporary receivers for the **Rosenband Mfg. Co.,** metal goods, of 44 Dickerson Street. Counsel for the Newark company consented to the appointments after receivership proceedings were filed by the **Solomon Investment Corp.,** of Dover, Del.

A bid of $468,360 for the assets of the **Bond Electric Corp.** of Jersey City, manufacturers of flashlights and batteries, has been approved by **Federal Judge Fake.** The bid was made by **Jay Cassler,** of Toronto and **Samuel Rudolph,** of Los Angeles. Receivership proceedings in Chancery Court began nearly three years ago and a petition for reorganization under the bankruptcy act was filed in June, 1934. It is said the business will be continued permanently.

Malthie Chemical Co., Newark, is constructing an addition to its factory on High Street to cost $55,000.

—C. A. L.

Trenton, N. J.

April 27, 1936.

Failure of the **Bartley Crucible and Refractories Co.,** formerly of Trenton, to effect a reorganization under provisions of Section 77-B, National Bankruptcy Act, was given by officers of the company as the reason for asking the Federal Court to dismiss the authority to reorganize granted a year ago. **Judge Forman,** on application of **Lewis H. Lawton,** president of the corporation, dismissed **Nathan Lane,** of Riverton, N. J., as trustee and returned control of the business to the corporation. The company, which made refractory containers and high temperature metals, ceased operations three months ago. **Mr. Lawton** said no decision has been made as to the future of the concern. The company was unsuccessful last April in having the city accept $15,000 as a compromise settlement of a $44,000 tax bill and hopes of negotiating a $65,000 loan with the **Reconstruction Finance Corporation** were not realized.

—C. A. L.

Middle Western States

Toledo, Ohio

April 27, 1936.

Industrial reports from different sections of this area indicate a general uptrend of business in the second quarter of this year with a notable increase as compared with the second quarter of 1935.

Combining automobile with autopart shipping requirements there will be needed 126,123 freight cars to handle the business in the second quarter. This is an increase of 20 per cent over the same period in 1935.

Practically all the motor car accessory plants are in heavy production with no indication of any kind of decline. Everything points now to a long season of manufacturing activity.

The plating plants also are busy, many of them under 24-hour schedules.

Another pleasing feature is the harmony which prevails in the ranks of labor. Strikes, which hampered industry a year ago, are now entirely out of the picture.

H. H. Shuart, who has managed the Detroit automobile shows for a number of years, has been called to assist in developing a comprehensive exhibit for the industry at the Great Lakes Exposition scheduled for this summer in Cleveland to celebrate the centennial anniversary of the city. This exposition will occupy 125 acres along the lake front and is to open June 27, continuing for 100 days.—F. J. H.

Detroit, Michigan

April 27, 1936.

Manufacturing in non-ferrous metal lines is active all through this area, with the prospects favorable for continuation through an indefinite period. Even though this is a presidential election year, business thus far shows no indication of slowing up as it did in the old days.

At the present time the motor car industry is struggling to keep up with orders. If conditions continue, this season will be the longest in the history of the industry. It opened several weeks earlier than usual and promises to continue through much of the summer.

Accessory manufacturers are in full operation with most of the plants producing to capacity.

Plating plants are as busy as ever. Their activity extends from before the first of the year. All will have plenty to do so long as the automotive demands are pressing.

Foundry plants also are in good production. The demand for aluminum and gray iron castings has been strong for many weeks.

Manufacturers of refrigeration units are as active as ever. Production is well maintained, with every indication of continuing over an extended period.

W. H. Burritt, vice-president in charge of sales, of the **Kelvinator Co.,** announces a 46 per cent increase in shipments, including household, commercial refrigeration and air conditioning equipment for the six months ending March 31.

The Mueller Brass Company, Port Huron, has been awarded two U. S. Government contracts totaling $39,051 calling for brass naval forgings and marine nuts and bolts.

Announcement is made that within the next two months operations will be started by the **Chrysler Corporation** in its new unit at Marysville, Mich., with an initial payroll of more than 300 men. **R. H. Fohey,** secretary of the corporation, recently told a gathering of the St. Clair River district leaders that the Chrysler organization hoped to employ several thousand men within a year at the Marysville plant, which would mean an annual payroll of $3,000,000 for that district. The company is spending several hundred thousand dollars on re-conditioning of the plant.

—F. J. H.

Pacific States

Los Angeles, California

April 27, 1936.

A new plant getting ready to open here is the **Airplane Development Co.,** with larger factory buildings, at Downey, a suburb. **Don P. Smith** is president, **Gerard F. Vultee,** chief engineer. They have orders for forty all metal monoplane bombers. A force of 7,500 men will be put on.

The **Enterprise Oil Burner Co.** of San Francisco will move their plant to Los Angeles and are now arranging for a location.

The **Consolidated Aircraft Corporation** of San Diego, having just finished building their new plant, now will have to make another enlargement, to cost $300,000. They now employ 1,900 men and 2,000 more will be put on. **C. A. Van Dusen** is works manager.

The **Lighted Hand Mfg. Co.,** are making electric hand signals, at 1521 S. Hoover St.

Thad Rose of the **Rose Lighter Than Air Corporation** of Van Nuys, is looking for a factory site at San Deigo to make a new type dirigible, having metal parts.

O'Keefe & Merritt Co. will build a $20,000 factory addition, at 3700 East Olympic Blvd., for stoves and refrigerators.

The **Miller Conditionair Co.** have opened a factory at 1134 South Main St. and have put in a plating plant.

The **Cold Liquid Metals Co.** have organized and starting a factory at 6100 South St. Andrews Place.

The **Covic Diesel Engine Co.,** now being organized at the Moreland Truck plant at Burbank, will soon locate a plant of their own. This will be a light Diesel for trucks, marine or stationary, to weigh 280 pounds. The engine block will be of aluminum alloy.

The **Caffers & Sattler Stove Works** at 4561 East 50th St., have started a new plant to do general enameling work.

The **Welcome Metal Co.** of Pasadena are now making coin metered radio sets to put in hotel rooms, portable, to play an hour for a dime.

The **H. M. Mfg. Co.** are enlarging the thermostat factory at 808 East 108th St.

Pernot & Rich have bought the buildings at 2526 San Fernando Road, having 39,000 square feet of space, to make air conditioning equipment.

The **Vering Mfg. Co.,** making refrigerators at 9106 Bandera St., are enlarging the factory.

The **American Foundry** at 906 Date St., are to enlarge factory.

The **Superior Casting Co.** have started a new foundry at 5926 Regent St.

The **M. Greitzer Mfg. Co.,** making metal furniture, are moving to a larger building, 637 Merchant St.

The **Johnson Mfg. Co.** are making metal chairs and tables at 908 South Gafeey St., San Pedro.

The **National Heating & Engineering Co.** of San Diego, have an exhibit at the Exposition there, of their new Marvellaire, an air conditioner.

Paul M. Raigorodsky, manager of the **Petroleum Engineers** of Tulsa, Okla., will manufacture an absorbtion type year around air conditioning unit, operated by natural gas.

The **Campbell Mfg. Co.** of 1328 Channing St., have a large output of dishwashing machines.—**H. S.**

Metal Market Review

April 30, 1936.

Copper moved up from 9.25c per pound, electrolytic, to 9.50, bringing all of the producers in line. Trade in the last two weeks in March was quiet although improving, becoming fairly active during the first week in April. The second week broke all records with sales at almost 135,000 tons, just before the price was advanced to 9½c. Naturally the balance of the month was almost dormant as will be evident from the total sales of 157,558 tons. Stocks are about 280,000 tons or about four months normal consumption.

Zinc stood firm at 4.90c per pound, Prime Western f.o.b. St. Louis. Business was slow for the last two weeks of March, improved a little during April and reacted slightly toward the close. Although the total month's business was only ordinary, the market was firm.

The U. S. Bureau of Mines has issued an advance summary of the zinc industry for 1935 showing that production in the United States amount to 449,284 short tons valued at $39,537,000, an increase of 17% in quantity and 20% in value for 1934. The Bureau issued an advance summary of rolled zinc in 1935 showing an output of 56,541 tons valued at $8,774,000, the highest production recorded since 1929, 38% higher in production and 41% higher in value than in 1934.

Tin was weak. During the last two weeks of March it slipped from 48.125c per lb. for Straits to 47.25. This trend continued through April and the month closed at 46.625. Trading was fair to dull with the outlook rather obscure.

Lead was unchanged at 4.60c per pound St. Louis. Sales were slack but improving during the last two weeks of March. In April the demand was fair and then improved quite steadily. Battery manufacturers and pigment makers were the backbone of the market.

Aluminum and **Nickel** were unmoved at 19-22c per pound and 35c per pound respectively.

Silver "stayed put" at 44¾c per ounce through March and the first two weeks of April. During the third week purchases for India and China raised it to 45.25 but it was reported that China was a heavy seller at the upper levels. During the last week silver reacted, slipping back to its post of 44.75.

Scrap metals continued to come in slowly to the refiners and toward the end of March three of the larger plants instituted a $1.50 per ton premium on 100 ton-contracts. In April the refiners cut their bids $1.00 per ton but the three refiners maintained their 7.5 point premium. The market remained firm and rumors were numerous that large quantities are being exported.

Brass ingot demand was slow in the latter part of March and the beginning of April. Later in the month it improved perceptibly until the last week, when it dropped again. A ¼c rise was made in special alloys.

On April 1, unfilled orders for brass and bronze ingots and billets on the books of the members of the Non-Ferrous Ingot Metal Institute amounted to a total of 18,914 net tons.

The combined deliveries of brass and bronze ingots and billets by the members for the month of March amounted to a total of 5,897 tons.

Average prices per pound received on commercial grades of six principal mixtures of ingot brass during the twenty-eight day period ending April 17th were:

80-10-10 (1½% Imp.)	10.815c
78% Metal	8.506c
81% Metal	8.755c
83% Metal	9.007c
85-5-5-5	9.278c
No. 1 Yellow Brass	7.538c

Wrought Metal operations remained at about the same level as in March. The floods operated to hold back production as well as receipt of raw materials and shipment of finished goods. Distribution in the Metropolitan area was about the same as in March and about 25% over April, 1935.

Average Metal Prices for March, 1936

Copper c/lb. Duty 4 c/lb.	
Lake (del. Conn. Producers' Prices)	9.312
Electrolytic (del. Conn. Producers' Prices)	9.250
Casting (f.o.b. ref.)	
Zinc (f.o.b. E. St. Louis) c/lb.	
Duty 1¾ c/lb.	8.950
Prime Western (for Brass Special add 0.05)	4.90
Tin (f.o.b. N. Y.) c/lb. Duty Free, Straits	47.994
Lead (f.o.b. St. L.) c/lb. Duty 2⅛ c/lb.	4.45
Aluminum c/lb. Duty 4c/lb.	20.50
Nickel c/lb. Duty 3 c/lb.	
Electrolytic 99.9%	35.00
Antimony (Ch. 99%) c/lb. Duty 2/lb.	13.420
Silver c/oz. Troy, Duty Free	44.750
Platinum $/oz. Troy, Duty Free	32.500
Gold—Official U. S. Treasury Price $/oz. Troy	35.00

Metal Prices, April 30, 1936

(Import duties and taxes under U. S. Tariff Act of 1930, and Revenue Act of 1932)

NEW METALS

Copper: Lake, 9.625, Electrolytic, 9.50, Casting, 9.20.
Zinc: Prime Western, 4.90. Brass Special, 5.00.
Tin: Straits 46.625.
Lead: 4.45. **Aluminum,** 19-22. **Antimony,** 13.50.
Nickel: Shot, 36. **Elec.,** 35.

Quicksilver: Flasks, 75 lbs., $76.50. **Bismuth,** $1.00. **Cadmium,** $1.05. **Silver,** Troy oz., official price, N. Y., April 30, 44.75. **Gold:** Oz. Troy, Official U. S. Treasury price, April 30, $35.00. **Scrap Gold,** 6¾c. per pennyweight per karat, dealers' quotation. **Platinum,** oz. Troy, $30.00.

Duties: Copper, 4c. lb.; zinc, 1¼c. lb.; tin, free, lead, 2½c. lb.; aluminum, 4c. lb.; antimony, 2c. lb.; nickel, 3c. lb.; quicksilver, 25c. lb.; bismuth, 7½%; cadmium, 15c. lb.; cobalt, free; silver, free; gold, free; platinum, free.

INGOT METALS AND ALLOYS

	Cents lb.	U S. Import Duty	Tax*
No. 1 Yellow Brass	7.75	None	4c. lb.[1]
85-5-5-5	9.50	None	4c. lb.[1]
88-10-2	12.50	None	4c. lb.[1]
80-10-10	11.00	None	4c. lb.[1]
Manganese Bronze (60,000 t. s. min.)	9.75	None	4c. lb.[1]
Aluminum Bronze	13.75	None	4c. lb.[1]
Monel Metal Shot or Block	28	25% a.v.	None
Nickel Silver (12% Ni)	11.50	20% a.v.	4c. lb.[1]
Nickel Silver (15% Ni)	15.00	20% a.v.	4c. lb.[1]
No. 12 Aluminum	16.50-20	4c. lb.	None
Manganese Copper, Grade A (30%)	18-23	25% a.v.	3c. lb.[1]
Phosphor Copper, 10%	11.25-14	3c. lb.	4c. lb.[1]
Phosphor Copper, 15%	13.25-15	3c. lb.	4c. lb.[1]
Silicon Copper, 10%	18.30	45% a.v.	4c. lb.[1]
Phosphor Tin, no guarantee	61-75	None	None
Iridium Platinum, 5%	$32-33	None	None
Iridium Platinum, 10%	$33-34	None	None

*Duty is under U. S. Tariff Act of 1930; tax under Section 60 (7) of Revenue Act of 1932.
[1]On copper content. [2]On total weight. "a. v." means ad valorem.

OLD METALS

Dealers' buying prices, wholesale quantities:

	Cents lb.	Duty	U. S. Import Tax
Heavy copper and wire, mixed	7⅛ to 7⅜	Free	4c. per pound on copper content
Light copper	6⅛ to 6⅜	Free	
Heavy yellow brass	4⅜ to 4⅝	Free	
Light brass	3⅝ to 3⅞	Free	
No. 1 composition	6⅛	Free	
Composition turnings	6	Free	
Heavy soft lead	3.90 to 4	2⅛c.lb	None.
Old zinc	2.85 to 3.00	1½c.lb.	
New zinc clips	3¾	1¼c.lb.	
Aluminum clips (new, soft)	14 to 14.25	4c.lb.	
Scrap aluminum, cast	12 to 12¼	4c.lb.	
Aluminum borings—turnings	6¼ to 6½	4c.lb.	
No. 1 pewter	29 to 30	Free	
Electrotype	4 to 4¼	2⅛c.lb.*	
Nickel anodes	29½ to 31	10%	
Nickel clips, new	32 to 33	10%	
Monel scrap	11 to 19	10% a.v.	

*On lead content.

Wrought Metals and Alloys

The following are net BASE PRICES per pound, to which must be added extras for size, shape, quantity, packing, etc., or discounts, as shown in manufacturers' price lists, effective since April 14, 1936. Basic quantities on most rolled or drawn brass and bronze items below are from 2,000 to 5,000 pounds; on nickel silver, from 1,000 to 2,000 pounds.

COPPER MATERIAL

	Net base per lb.	Duty*
Sheet, hot rolled	16¾c.	2½c. lb.
Bare wire, soft, less than carloads	13¼c.	25% a. v.
Seamless tubing	17½c.	7c. lb.

*Each of the above subject to import tax of 4c. lb. in addition to duty, under Revenue Act of 1932.

BRASS AND BRONZE MATERIAL

	Yellow Brass	Red Brass 80%	Comm'l. Bronze	Duty	
Sheet	14⅞c.	15¾c.	16⅝	4c. lb.	U. S. Import Tax 4c. lb. on copper content.
Wire	15⅜c.	16¼c.	17⅛	25%	
Rod	13⅜c.	16¼c.	17	4c. lb.	
Angles, channels	22⅞c.	24 c.	24⅝	12c. lb.	
Seamless tubing	17⅜c.	18 c.	18⅞	8c. lb.	
Open seam tubing	22⅞c.	24 c.	24⅝	20% a.v.	

NICKEL SILVER

Net base prices per lb. (Duty 30% ad valorem.)

Sheet Metal		Wire and Rod	
10% Quality	28¼c.	10% Quality	27 c.
15% Quality	26¼c.	15% Quality	31⅜c.
18% Quality	27½c.	18% Quality	34⅝c.

TOBIN BRONZE AND MUNTZ METAL

(Duty 4c. lb.; import tax 4c. lb. on copper content.)

Net base prices per pound.	
Tobin Bronze Rod	17 c.
Muntz or Yellow Rectangular and other sheathing	18⅛c.
Muntz or Yellow Metal Rod	14½c.

ALUMINUM SHEET AND COIL

(Duty 7c. per lb.)

Aluminum sheet, 18 ga., base, ton lots, per lb. 32.80
Aluminum coils, 24 ga., base price, ton lots, per lb. 30.50

ROLLED NICKEL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Net Base Prices

Cold Drawn Rods	49c.	Cold Rolled Sheet	53c.
Hot Rolled Rods	44c.	Standard Sheet	48c.

MONEL METAL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Hot Rolled Rods (base)	34	Standard Sheets (base)	38
Cold Drawn Rods (base)	39	Cold Rolled Sheets (base)	43

SILVER SHEET

Rolled sterling silver (April 30) 47c. per Troy oz. upward according to quantity. (Duty, 65% ad valorem.)

ZINC AND LEAD SHEET

	Cents per lb. Net Base	Duty
Zinc sheet, carload lots, standard sizes and gauges, at mill, less 7 per cent discount	9.50	2c. lb.
Zinc sheet, 1200 lb. lots (jobbers' price)	10.25	2c. lb.
Zinc sheet, 100 lb. lots (jobbers' price)	14.25	2c. lb.
Full Lead Sheet (base price)	8.00	2⅜c. lb.
Cut Lead Sheet (base price)	8.25	2⅜c. lb.

BLOCK TIN, PEWTER AND BRITANNIA SHEET

(Duty Free)

This list applies to either block tin or No. 1 Britannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f. o. b. mill:

500 lbs. over	15c. above N. Y. pig tin price
100 to 500 lbs.	17c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price

Supply Prices on page 206.

Supply Prices, April 30, 1936

ANODES

Prices, except silver, are per lb. f.o.b., shipping point, based on purchases of 500 lbs. or more, and subject to changes due to fluctuating metal markets.

Copper: Cast	16½c. per lb.	**Nickel:** 90-92%	.45 per lb.
Electrolytic, full size, 14½c. cut to size	14½c. per lb.	95-97%	.46 per lb.
Rolled oval, straight, 15c.; curved,	15¾c. per lb.	99%+cast, 47c.; rolled, depolarized, 48.	
Brass: Cast:	17¼c. per lb.	**Silver:** Rolled silver anodes .999 fine were quoted April 30, from 48c. per Troy ounce upward, depending on quantity.	
Zinc: Cast	10⅛c. per lb.		

WHITE SPANISH FELT POLISHING WHEELS

Diameter	Thickness	Under 50 lbs.	50 to 100 lbs.	Over 100 lbs.
10-12-14 & 16	1" to 2"	$2.95/lb.	$2.65/lb.	$2.45/lb.
10-12-14 & 16	2 to 3½	2.85	2.55	2.35
6-8 & over 16	1 to 2	3.05	2.75	2.55
6-8 & over 16	2 to 3½	3.00	2.70	2.45
6 to 24	Under ½	4.25	3.95	3.75
6 to 24	½ to 1	3.95	3.65	3.45
6 to 24	Over 3½	3.35	3.05	2.85
		Any Quantity		
4 to 6	Under ½,	$5.00	½-1, $4.85	1 to 3, $4.75
1½ to 4	"	5.55	" 5.40	" 5.35
1 to ½	"	5.85	" 5.70	" 5.60

Extras: 25c per lb. on wheels, 1 to 6 in. diam., over 3 in. thick. On grey Mexican wheels deduct 10c. per lb. from above prices.

COTTON BUFFS

Full disc open buffs, per 100 sections when purchased in lots of 100 or less are quoted:

16" 20 ply 84/92 Unbleached	$71.13
14" 20 ply 84/92 Unbleached	54.58
12" 20 ply 84/92 Unbleached	41.09
16" 20 ply 80/92 Unbleached	59.37
14" 20 ply 80/92 Unbleached	45.64
12" 20 ply 80/92 Unbleached	34.45
16" 20 ply 64/68 Unbleached	51.26
14" 20 ply 64/68 Unbleached	39.47
12" 20 ply 64/68 Unbleached	29.86
⅜" Sewed Buffs, per lb., bleached or unbleached	48c. to 1.12

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone C. P.	lb.	.10-.15
Acid—Boric (Boracic) granular, 99½+% ton lots	lb.	.05¼-.05¾
Chromic, 400 or 100 lb. drums		.16¾
Hydrochloric (Muriatic) Tech., 20 deg., carboys	lb.	.03
Hydrochloric, C. P., 20 deg., carboys	lb.	.06½
Hydrofluoric, 30%, bbls.	lb.	.07-.08
Nitric, 36 deg., carboys	lb.	.05-.06¼
Nitric, 42 deg., carboys	lb.	.07-.08
Sulphuric, 66 deg., carboys	lb.	.02
Alcohol—Butyl, drums	lb.	.09½-.12
Denatured, drums	gal.	.475-.476
Alum—Lump, barrels	lb.	.03¼-.03½
Powdered, barrels	lb.	.0340-.0365
Ammonia, aqua, com'l., 26 deg., drums, carboys	lb.	.02½-.05
Ammonium—Sulphate, tech., bbls.	lb.	.03½-.05
Sulphocyanide, technical crystals, kegs	lb.	.55-.58
Arsenic, white kegs	lb.	.04½-.05
Asphaltum, powder, kegs	lb.	.23-.41
Benzol, pure, drums	gal.	.41
Borax, granular, 99½+%, ton lots	lb.	.0245-.0295
Cadmium oxide, 50 to 1,000 lbs.	lb.	.85
Calcium Carbonate (Precipitated Chalk), U. S. P.	lb.	.05¾-.07½
Carbon Bisulphide, drums	lb.	.05½-.06
Chrome, Green, commercial, bbls.	lb.	21½-23½
Chromic Sulphate, drums	lb.	.33-.55
Copper—Acetate (Verdigris)	lb.	.21
Carbonate, 53/55% cu., bbls.	lb.	.15½
Cyanide (100 lb. kgs.)	lb.	.38-.40
Sulphate, tech., crystals, bbls.	lb.	4.55-5c.
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.20¼-.20½
Crocus Martis (Iron Oxide) red, tech., kegs.,	lb.	.07
Dextrin, yellow, kegs	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton	30.00
Fluorspar, bags	lb.	.03½
*Gold Chloride	oz.	$18¼-23
*Gold Cyanide, Potassium		$15.45
*Gold Cyanide, Sodium		$17.10
Gum—Sandarac, prime, bags	lb.	.50
Shellac, various grades and quantities	lb.	.21-.31
Iron Sulphate (Copperas), bbls.	lb.	.016
Lead—Acetate (Sugar of Lead), bbls.	lb.	.10-.13½
Oxide (Litharge), bbls	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Methanol, (Wood Alcohol) Pure, drums	gal.	.42½
Nickel—Carbonate, dry, bbls.	lb.	.35-.41
Chloride, bbls.	lb.	.18-.22
Salts, single, 425 lb. bbls.	lb.	.13½-.14½
Salts, double, 425 lb. bbls.	lb.	.13½-.14½
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity	lb.	.35-.40
Potash Caustic Electrolytic 88-92% broken, drums	lb.	.07¼-.08½
Potassium—Bichromate, casks (crystals)	lb.	.09
Carbonate, 96-98%	lb.	.07½
Cyanide, 165 lbs. cases, 94-96%	lb.	.57½
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Rouge—Nickel, 100 lb. lots	lb.	.08
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in bbls.	lb.	.05-.07½
*Silver—Chloride, dry, 100 oz. lots	oz.	.38¼
Cyanide, 100 oz. lots	oz.	.46-.50
Nitrate, 100 ounce lots	oz.	.32¾
Soda Ash, 58%, bbls.	lb.	.0252
Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.17½-.22
Hyposulphite, kegs, bbls.	lb.	.03½-.06½
Metasilicate, granular, bbls.	lb.	3.15-3.30
Nitrate, tech., bbls.	lb.	.02¼
Phosphate, tribasic, tech., bbls.	lb.	.0350
Silicate (Water Glass), bbls.	lb.	.01½
*Stannate, drums	lb.	.31½-.34½
Sulphocyanide, drums	lb.	.30-.45
Sulphur (Brimstone), bbls.	lb.	.02
*Tin Chloride, 100 lb. kegs	lb.	.36½
Tripoli, powdered	lb.	.03
Trisodium Phosphate—see Sodium Phosphate.		
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½-.06
Zinc—Carbonate, bbls.	lb.	.11-.12
Cyanide (100 lb. kegs)	lb.	.028-.037
Chloride, drums, bbls.	lb.	.37
Sulphate, bbls.	lb.	.07½-.10

*Subject to fluctuations in metal prices.